HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Cowlitz River Winter-late Steelhead (Integrated)
Species or Hatchery Stock:	Winter-late Steelhead (*Oncorhynchus mykiss*) Cowlitz Trout Hatchery
Agency/Operator:	Washington Department of Fish and Wildlife Tacoma Power
Watershed and Region:	Cowlitz River/Lower Columbia
Date Submitted:	
Date Last Updated:	August 29, 2014

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Executive Summary

The Washington Department of Fish and Wildlife is submitting a Hatchery and Genetic Management Plan (HGMP) for the Cowlitz River Winter-late Steelhead program to the National Marine Fisheries (NMFS) for consultation under Section 10(a)(1)(A) or 4(d) of the Endangered Species Act (ESA). NMFS will use the information in this HGMP to evaluate the hatchery impacts on salmon and steelhead listed under the ESA. The primary goal of an HGMP is to devise biologically-based hatchery management strategies that ensure the conservation and recovery of salmon and steelhead populations. This HGMP focuses on the implementation of hatchery reform actions adopted by the Washington Fish and Wildlife Commission Policy on Hatchery and Fishery Reform C-3619.

The purpose of the program is to produce Cowlitz River endemic winter-late steelhead for escapement to the watershed, while providing recreational fisheries under mark-selective fishery regulations. Program fish will be produced at the Cowlitz Hatchery Complex (Cowlitz Salmon and Cowlitz Trout Hatcheries), on the Cowlitz River (WRIA 26.0002). The program will annually release around 644,000 yearlings to the lower Cowlitz River. The In-season Implementation Tool (ISIT) is used on an annual basis to monitor the program and compliance with Hatchery Scientific Review Group (HSRG) standards.

This endemic winter-late steelhead HGMP is built around the principles and recommendations of the Hatchery Scientific Review Group (HSRG). These principles and recommendations represent the best science available for operating hatchery facilities consistent with the conservation of salmonid species. The program has been operated as an "integrated type" program, as defined by the HSRG, since 2012. An "integrated" program is one in which natural-origin individuals are used in hatchery broodstock. Integration is achieved by utilizing adult natural-origin winter-late steelhead (distinguished by an intact adipose fin) returning to the Cowlitz River at the Cowlitz Salmon Hatchery trap (RKm 79.0 collected and spawned from mid-March through May. All fish released through this hatchery program have been 100% mass-marked (adipose fin-clipped) since 1995.

The Lower Columbia River steelhead are listed as "Threatened" under the ESA. The DPS includes the Cowlitz Trout Hatchery Late Winter-run Program.

Broodstock Collection:
The broodstock is derived from natural-origin stock returning to the Cowlitz sub-basin. The current egg-take goal is 631,000 at Cowlitz Salmon Hatchery; around 234 adult pairs may be collected. In addition, 135 adults are needed to meet Upper Cowlitz and Tilton River broodstock needs to achieve an annual egg-take goal of 156,000 and 63,300, respectively. The Fisheries and Hatchery Management Plan (FHMP 2011) places no limits on the number of HOR winter-late steelhead released into the upper Cowlitz or Tilton River from the integrated program returns.

Harvest:
Total annual harvest is dependent on management response to annual abundance in *Pacific Salmon Commission* (PSC - U.S./Canada), *Pacific Fishery Management Council* (PFMC - U.S. ocean), and *Columbia River Compact* forums. WDFW has also received authorization for tributary, Columbia River mainstem, and ocean fisheries; the combined harvest rates in the *Fisheries Management and Evaluation Plan* (FMEP), *Columbia River Fish Management Plan* (CRFMP), and ocean fisheries are reviewed annually in the North of Falcon process to ensure the harvest rates are consistent with recovery of the Lower Columbia River Tule Chinook population. The *U.S. v Oregon* Technical Advisory Committee (TAC) has prepared Biological Assessments (BAs) for combined fisheries based on relevant *U.S. v Oregon* management plans and agreements. The current BA concerns Columbia River treaty Indian and non-Indian fisheries, as described in the "2008–2017 *U.S. v Oregon* Management Agreement for upriver Chinook, sockeye, steelhead, coho, and white sturgeon" (2008–2017 MA).

Under permanent regulations, the mainstem Columbia River is open to the retention of hatchery steelhead beginning May 16 from the Tongue Point/Rocky Point line upstream to the I-5 Bridge and June 16 from the I-5 Bridge upstream to the Oregon/Washington border above McNary Dam. The steelhead fishery is

closed under permanent regulations during April 1–May 15 between Tongue Point and the I-5 Bridge and April 1–June 15 upstream of I-5, when spring Chinook abundance is high.

Due to a lack of coded-wire tag studies and limitations that not all fish can be accounted for as being harvested or as back-to-rack counts, smolt-to-adult survival rates (SAR) are likely underestimated. Average SAR for brood years 2001-2008 is 1.97%. The minimum adult escapement goal for natural production is 1,000.

Monitoring and Evaluation:
Performance indicators for harvest will be accomplished by continuing mass-marking (adipose fin-clip); CWT recoveries help determine stray rate contributions on spawning grounds by watersheds close in proximity to this program's release vicinity. WDFW is implementing a genetic monitoring program to measure introgressive hybridization between segregated hatchery steelhead and wild populations.

In addition, temporary fish collection weirs have been installed, and operated on the lower Cowlitz tributaries since 2012. Operation of these weirs allow WDFW to collect natural origin broodstock and to control the number of hatchery winter-late steelhead reaching natural spawning locations, thereby benefiting natural production in these basins. Additionally, this project funds spawning ground survey activities to monitor the effectiveness of these weirs and allow for the calculation of important hatchery performance metrics, such as pHOS. Deliverables include estimates of pHOS, and trapping efficiency.

Operation and Maintenance of Hatchery Facilities:
WDFW's Cowlitz winter-late steelhead program uses two facilities. The facility farthest upstream is the Cowlitz Salmon Hatchery, which draws water from multiple sources: wells with a water right of 4,920 gpm; and an intake on the Cowlitz River, with a water right of 200 cfs. Intake and screen criteria are in compliance with state and federal guidelines (NOAA-NMFS 1995, 1996), but do not meet the current Anadromous Salmonid Passage Facility Design criteria (NOAA-NMFS 2011). Tacoma Power is investigating the intake to see if reasonable measures could result in improvements. The Cowlitz Salmon Hatchery operates under the *"Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System* (NPDES) general permit which conducts effluent monitoring and reporting and operates within the limitations established in its permit administered by the Washington Department of Ecology (DOE). Cowlitz Trout Hatchery has multiple water sources: 4,861 gpm water right from nine wells and a river intake with a water right of 56 cfs and an ozone plant capable of treating up to 20 cfs.

1 SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1 Name of hatchery or program.

Cowlitz River Winter-late Steelhead

1.2 Species and population (or stock) under propagation, and ESA status.

Cowlitz Trout Hatchery Steelhead (*Oncorhynchus mykiss*) - winter-late run

ESA Status: Threatened (63FR13347); reaffirmed on January 5, 2006 (70FR37160); reaffirmed August 15, 2011 (76 FR 50448).

1.3 Responsible organization and individuals

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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

Tacoma Power - Funding Source and Cowlitz Salmon and Trout Hatcheries Facility Owner

1.4 Funding source, staffing level, and annual hatchery program operational costs.

Funding Sources	Operational Information
Tacoma Power	Full time equivalent staff – 8.6 Annual operating cost (dollars) - $1,262,865 (Specific costs to program cannot be broken out separately).

1.5 Location(s) of hatchery and associated facilities.

Broodstock Source: Cowlitz River winter-late steelhead

Table 1.5.1: Location of culturing phases, by facility.

Facility	Culturing Phase	Location
Cowlitz Salmon Hatchery	Broodstock collection, adult holding/spawning, incubation, and early-rearing	Located on the Cowlitz River (WRIA 26.0002) at RKm 79.0, tributary to the Columbia River at RKm 109.4 Lower Columbia River, Washington.
Cowlitz Trout Hatchery	Final-rearing, Acclimation, Release	Located on the Cowlitz River (WRIA 26.0002) at RKm 66.0, tributary to the Columbia River at RKm 109.4 Lower Columbia River, Washington.

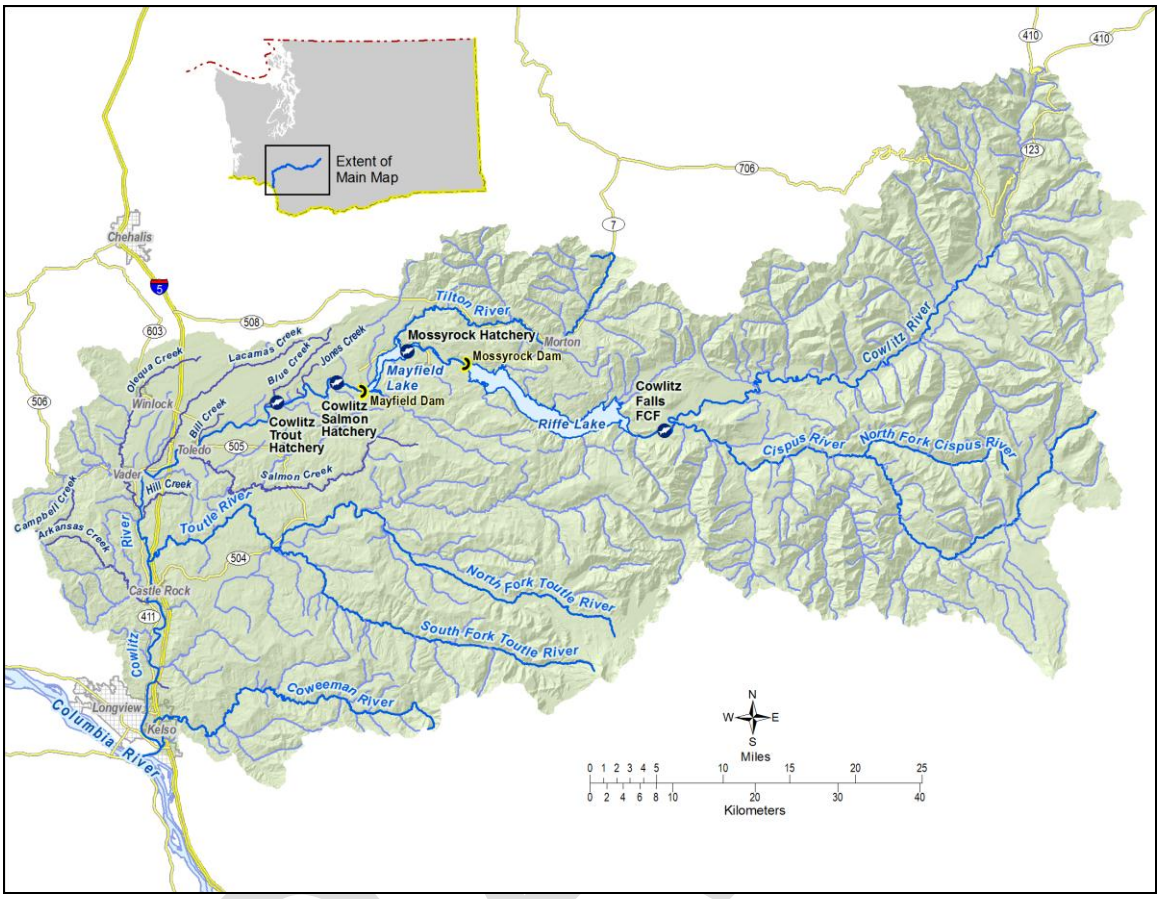


Figure 1.5.1: Map of Cowlitz Basin and facilities. Source: WDFW GIS 2014.

1.6 Type of program.

Integrated Harvest

1.7 Purpose (Goal) of program.

Mitigation/Augmentation. The purpose of this program is to: 1) contribute to sport harvest in the lower Cowlitz River and lower Columbia River/Estuary; 2) re-establish and conserve naturally-producing populations of winter-late steelhead into the upper Cowlitz River and tributaries; and, 3) contribute to research and education through mitigation for development (including hydro-power) and habitat degradation. The new Cowlitz River Hydroelectric Project Settlement Agreement (SA) has prioritized restoring ecosystem integrity with the restoration and recovery of wild, indigenous salmonid runs, including ESA-listed and unlisted stocks, to harvestable levels (The Cowlitz River Project, Federal Energy Regulatory Commission (FERC) No. 2016, August 2000).

In order to achieve these goals, the endemic hatchery stocks will serve as gene banks for native Cowlitz basin stocks of fish and be used to rebuild and restore wild stocks and provide continued harvest opportunities. During the current FHMP (update 2011), a level of integration of wild fish into the existing broodstock will be implemented. **See Section 3.3.1.**

1.8 Justification for the program.

The program is funded through the Tacoma Power for the purpose of mitigation for lost fish production due to hydro-power development within the Cowlitz River basin. WDFW protects listed fish and provides harvest opportunity on hatchery fish through the Lower Columbia River *Fish Management and Evaluation Plan* (FMEP, WDFW 2001) and the Cowlitz River *Fisheries and Hatchery Management Plan* (FHMP, update 2011). Prior to the completion of the Mayfield

and Mossyrock Dams, the upper basin produced up to 22,000 winter steelhead annually. The construction of Mayfield and Mossyrock Dams blocked access to approximately 50% of historical spawning habitat (Myers et al. 2003). Over 249 miles of historical anadromous fish habitat, including steelhead habitat in the mainstem Cowlitz River, Muddy Fork, and Clear Fork, and in the Tilton and lower Ohanapecosh Rivers, is blocked to volitional passage by the Project dams (Harza 1999a). Three historical populations in the upper Cowlitz River basin including Cispus, Tilton and upper Cowlitz winter run segments have been extirpated, but are incorporated within the late winter steelhead hatchery stock (Myers et al. 2003 and WCSBRT 2003).

By the late 1990s, most indigenous anadromous populations in the Lower Columbia ESU, including the Cowlitz River system, were either "depressed," "proposed for," "candidate species" or "listed" under the Endangered Species Act (ESA). The new Cowlitz River Hydroelectric Project Settlement Agreement (SA) has prioritized restoring ecosystem integrity with the restoration and recovery of wild indigenous salmonid runs, including ESA-listed and unlisted stocks, to harvestable levels (The Cowlitz River Project, FERC No. 2016, August 2000). To achieve these goals, the endemic hatchery stocks will serve as gene banks for native Cowlitz basin stocks, and be used to rebuild and restore wild stocks and provide continued harvest opportunities. During the current FHMP (update 2011), natural-origin fish will be integrated into the existing broodstock. Until 2012, only marked hatchery broodstock have been used. The non-endemic early winter steelhead program was eliminated in 2012 to reduce impact on the winter-late steelhead.

This program will be used to restore natural spawning populations of winter steelhead in the upper Cowlitz River basin. Objectives include hatchery production, and reintroduction of adults to the upper watershed and carcass nutrient enhancement, along with fish passage improvements and fishery management strategies (FERC No. 2016). Natural-origin broodstock will be integrated (based on HSRG guidelines) when the current winter-late steelhead reintroduction effort is deemed successful at providing a locally-adapted stock from the current hatchery stock, **See Section 3.3.1**. Natural-origin and hatchery adult steelhead spawners have been transported to the Tilton, upper Cowlitz and Cispus River systems from 1996 through 2009. Once adults from the integrated program begin to return (2015) late winter steelhead adults with a right ventral fin-clip (upper Cowlitz origin) captured at Cowlitz Salmon Hatchery (CSH) will be transported and released in the upper Cowlitz watershed to provide a harvest opportunity for anglers and provide additional spawners for the restoration program. Late winter steelhead adults with a left ventral fin-clip (Tilton River origin) captured at CSH will be transported and released in the Tilton River to provide a harvest opportunity for anglers and provide additional spawners for the restoration program.

WDFW protects listed fish and provides harvest opportunity on the steelhead programs through the Lower Columbia Region Fish Management and Evaluation Plan (FMEP) submitted to NOAA on December 31, 2003. The primary focus of anadromous salmonid fisheries in the Lower Columbia River (LCR) is to target harvest of known hatchery-origin steelhead, spring Chinook, coho salmon, sea-run cutthroat, and fall Chinook. The primary focus for resident game and non-game fish in the LCR tributaries is to 1) provide recreational opportunities, 2) minimize impacts to juvenile anadromous fish through time and area closures, and 3) minimize impacts to listed species.

In order to minimize impacts on listed fish by WDFW facilities operation and the Cowlitz River winter (late) steelhead program, the following Risk Aversions are included in this HGMP.

Table 1.8.1: Summary of risk aversion measures for the Cowlitz winter-late steelhead program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.2	Water rights are formalized through trust water rights from the Department of Ecology. Monitoring and measurement of water usage is reported in monthly NPDES reports.

Intake Screening	4.2	An intake structure at Cowlitz Trout Hatchery is in compliance with state and federal guidelines (NOAA-NMFS 1995, 1996), but does not meet the current *Anadromous Salmonid Passage Facility Design* criteria (NOAA-NMFS 2011).
Effluent Discharge	4.2	This facility operates under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) administered by the Washington Department of Ecology (DOE) WAG 13-1034.
Broodstock Collection & Adult Passage	7.9	Facility follows WDFW broodstock collection and sorting protocols; any non-target listed fish can be quickly identified and, if encountered, are released back to the stream to minimize impacts.
Disease Transmission	2.2.3, 7.9, 10.11	The *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006) and the *Fish Health Policy in the Columbia Basin* details hatchery practices and operations designed to stop the introduction and/or spread of any diseases within the Columbia Basin. Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Fish Health Policy Chapter 5, IHOT 1995).
Competition & Predation	2.2.3, 10.11	Fish are released as smolted yearlings that emigrate from the system and Columbia River within the year of release (Sharpe et al. 2008, Topping and Zimmerman 2011, Pflug et al. 2013). Current risk aversions and future considerations are being reviewed and evaluated for further minimizing impacts to listed fish.

1.9 List of program "Performance Standards".

See HGMP section 1.10. Performance Standards below pertain to the hatchery production at Cowlitz Salmon and Trout Hatcheries (CSH & CTH) only and do not contain complete indicators for the upriver reintroduction program. For further information on upriver performance indicators and standards, refer to the FHMP (update 2011).

1.10 List of program "Performance Indicators", designated by "benefits" and "risks."

1.10.1 "Performance Indicators" addressing benefits.

Table 1.10.1: "Performance Indicators" addressing benefits.

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.2 Program contributes to mitigation requirements. Program provides mitigation for lost fish production due to development within the Columbia River Basin and contributes to sport and commercial fisheries (Columbia River Fish Management Plan, *U.S. v Oregon*).	Number of fish released by program returning, or caught, as applicable to given mitigation requirements.	Annually estimate survival and contribution to fisheries for each brood year released. Fry/fingerling releases consistent with Fisheries Technical Committee (FTC) and FHMP goals. This program provides mitigation for lost fish production due to hydro-power development within the Cowlitz

		system; contributes to estuary sport and commercial, and lower Cowlitz River sport fisheries, and supports Upper Cowlitz basin restoration and recovery.
3.1.3 Program addresses ESA responsibilities.	Program complies with Federal ESA-listed fish take authorizations for harvest and hatchery actions.	HGMP updated and re-submitted to NOAA with significant changes or under permit agreement.
3.2.1 Fish produced for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding overharvest of non-target species.	Annual number of fish produced by program caught in all fisheries, including estimates of fish released.	Annually mass-mark hatchery steelhead releases to differentiate hatchery from natural-origin fish and record estimates of mark rate. The external mark enables mark-selective fisheries, which can reduce directed harvest mortality on natural-origin fish. Agencies monitor harvests and hatchery returns to provide up-to-date information. Estimate survival and contribution to fisheries for each brood year released.
3.3.2 Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production, and to evaluate effects of the program on the local natural population.	Number of marks released and estimated proportion of marks in out-migrant juveniles and returning adults. Percentage of total hatchery releases mass-marked (fin clips, otoliths, tags, etc., depending on species) to allow for their differentiation from naturally-produced fish as returning adults.	Annually monitor and report size, number, date of release and mass-mark quality (adipose fin-clip rate) of all hatchery releases. Annually sample returning fish for the adipose fin-clip in fisheries and at the hatchery; record numbers of estimated hatchery (marked) and natural (unmarked) fish.
3.4.1 Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of population from which broodstock is taken.	Temporal distribution of broodstock collection at point of collection.	Collect broodstock representatively and systematically throughout the early portion of the return (mid-March through May). Collect annual run timing, age and sex composition and spawning escapement timing data. Adhere to WDFW spawning guidelines (Seidel 1983; HSRG 2009).
3.5.5 Juveniles are released at fully-smolted stage to benefit juvenile to adult survival rates, and reduce the likelihood for residualism and negative ecological interactions with	Smoltification status (size fpp/mass CV and condition factor) and behavior are monitored in the hatchery. Yearling fish released at 8 fpp; two-year smolts released at 6	Monitor fish condition in the hatchery throughout all rearing stages. Annually monitor and record size, number, and date of release.

natural-origin fish.	fpp.	
3.6.1 The hatchery program uses standard scientific procedures to evaluate various aspects of artificial propagation.	Apply minimal monitoring standards in the hatchery: food conversion rates, growth trajectories, mark/tag rate error, weight distribution (CV).	Collect annual run timing, age and sex composition data upon adult return. Annually record growth rates, mark rate and size at release and release dates. Adhere to HSRG (2009) and WDFW spawning guidelines (Seidel 1983). See also HGMP section 11 for program monitoring and evaluation.
3.8.3 Non-monetary societal benefits for which the program is designed are achieved.	Program is designed to help achieve the end goal of conserving and stabilizing natural salmon populations.	Long-term monitoring of system population will indicate success of program.
3.8.3 Non-monetary societal benefits for which the program is designed are achieved.	Provide information about agency programs and hatchery operations to such internal and external audiences as local schools and special interest groups. Off station efforts may include festivals, classroom participation, stream adoptions and fairs.	Record on-station organized education and outreach events. Evaluate use and/or exposure of program materials and exhibits as they help support goals of the information and education program.

1.10.2 "Performance Indicators" addressing risks.

Table 1.10.2.1: "Performance indicators" addressing risks.

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.3 Program addresses ESA responsibilities	Program complies with Federal ESA-listed fish take authorizations for harvest and hatchery actions.	HGMP is updated to reflect any major changes in program and resubmitted to NOAA fisheries. Program risks have been addressed in this HGMP through best available science hatchery management actions. Monitor and record juvenile hatchery fish size, number, date of release and mass-mark quality; monitor contribution of hatchery adult fish to fisheries and escapement.
3.2.1 Fish produced for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while adequately minimizing by-catch of non-target species.	Number of marks released and estimated proportion of marks in out-migrant juveniles and returning adults on the spawning ground. Production fish are mass-marked (adipose fin-clip) to allow for their differentiation from	Monitor and record juvenile hatchery fish size, number, date of release and mass-mark quality; monitor contribution of hatchery adult fish to fisheries and escapement. Harvest is regulated to meet appropriate biological

	naturally-produced fish	assessment criteria. Agencies monitor harvests and hatchery escapements to provide up-to-date information.
3.2.2 Release groups are sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.	Percentage of total hatchery releases are identifiable as hatchery-origin fish. Mass-mark (adipose-fin clip, CWT, otolith-mark, etc., depending on species) produced fish to allow for their differentiation from naturally produced fish for selective fisheries.	Annually monitor and report mass-mark type, quality and rates. Assess annual harvest of mass-marked hatchery fish based on CWT recovery estimates and creel surveys (see HGMP section 3.3.1).
3.3.2 Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production and to evaluate effects of the program on the local natural population.	All hatchery production is identifiable in some manner (fin-marks, tags, otolith, etc.) consistent with information needs.	Annually monitor and record size, number, date of release and mass-mark quality (adipose fin-clip rate) of all hatchery releases. Examine returning fish encountered for the mass-mark (CWT) at the hatchery and on the spawning ground. Annually record numbers of estimated hatchery (marked) and natural (unmarked). This program was modelled to meet HSRG standards for pHOS using the ISIT tool. Program is reviewed annually.
3.4.1 Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of population from which broodstock is taken.	Temporal and age distribution of broodstock collected, compared to that of naturally-produced population at collection point.	Collect annual run timing, age and sex composition and return timing data.
3.4.2 Broodstock collection does not significantly reduce potential juvenile production in natural rearing areas.	Number of spawners of natural-origin removed for broodstock.	Trap is checked daily. Non-target listed fish, when encountered, are returned to the river.
3.5.1 Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.	Within and between populations, genetic structure is not affected by artificial production.	Conduct genetic monitoring of the hatchery and natural populations (see HGMP section 11.1).
3.5.2 Collection of broodstock does not adversely impact the genetic diversity of the naturally-spawning population.	Total number of natural-origin spawners (if any) reaching the collection facility. Timing of collection compared to overall run timing.	All hatchery production is identifiable in some manner (fin-marks, tags, etc.). Collect annual run timing, origin, and age and sex composition data. Examine returning fish for the mass-mark (adipose fin-clip) at broodstock collection points and

		on the spawning grounds. Annually record and report numbers of estimated hatchery (marked) and natural (unmarked).
3.5.4 Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations.	Location of release (on-station, acclimation pond, direct plant). Release type (forced, volitional or direct stream release).	Annually record and report release information, including location, method and age class in hatchery data systems (WDFW Hatcheries Headquarters Database).
3.5.5 Juveniles are released at fully-smolted stage.	Level of smoltification at release. Release type (forced, volitional or direct).	Annually monitor and record size, number, date of release and release type.
3.7.1 Hatchery facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols (IHOT, PNFHPC, *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State*).	Annual reports indicating levels of compliance with applicable standards and criteria. Periodic audits indicating level of compliance with applicable standards and criteria.	Pathologists from WDFW's Fish Health Section monitor program monthly. Exams performed at each life stage may include tests for virus, bacteria, parasites and/or pathological changes, as needed. The program is operated consistent with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).
3.7.2 Effluent from hatchery facility will not detrimentally affect natural populations.	Discharge water quality compared to applicable water quality standards by NPDES permit. Washington Department of Ecology (WDOE) water right permit compliance.	Flow and discharge reported in monthly NPDES reports.
3.7.3 Water withdrawals and in-stream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.	Water withdrawals compared to NMFS, USFWS and WDFW applicable passage and screening criteria for juveniles and adults.	Barrier and intake structure compliance assessed and needed fixes are prioritized.
3.7.4 Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens. Follow the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, revised 2006).	Necropsies of fish to assess health, nutritional status, and culture conditions.	WDFW Fish Health Section inspects adult broodstock yearly for pathogens and monitor juvenile fish on a monthly basis to assess health and detect potential disease problems. As necessary, WDFW's Fish Health Section recommends remedial or preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary. A fish health

		database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings.
	Release and/or transfer exams for pathogens and parasites.	Examine fish 1 to 6 weeks prior to transfer or release, in accordance with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).
	Inspection of adult broodstock for pathogens and parasites.	At spawning, all females are examined for pathogens.
	Inspection of off-station fish/eggs prior to transfer to hatchery for pathogens and parasites.	Controls of specific fish pathogens through eggs/fish movements are conducted in accordance to the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).
3.7.6 Adult broodstock collection operation does not significantly alter spatial and temporal distribution of any naturally-produced population.	Spatial and temporal spawning distribution of natural populations above and below broodstock collection site is currently compared to historic distribution.	Not monitored at this time.
3.7.7 Weir/trapping operations do not result in significant stress, injury or mortality in natural populations.	Mortality rates in trap. Pre-spawning mortality rates of captured fish in the hatchery and/or after release.	Traps checked daily. Annually record and report abundances and observations of natural-origin fish at hatchery facilities.
3.7.8 Predation by artificially produced fish on naturally – produced fish does not significantly reduce numbers of natural fish.	Hatchery juveniles are raised to smolt-size and released from the hatchery at a time that fosters rapid migration downstream.	Hatchery smolt release size and time are monitored to quantify/minimize predation effects on naturally produced Chinook (Sharpe et al. 2008, Topping and Zimmerman 2011.

1.11 Expected size of program.

1.11.1 Proposed annual broodstock collection level (maximum number of adult fish).

Around 234 adults collected annually. The annual egg-take goal is 633,000 for the lower Cowlitz releases (FBD 2014). **See Table 1.11.2.1.**

An additional 135 adults are needed to meet upper Cowlitz (79) and Tilton River (56) broodstock needs. These programs have an annual egg-take goal of 156,000 and 63,300, respectively. **See Table 1.11.2.1.**

1.11.2 Proposed annual fish release levels (maximum number) by life stage and location.

Table 1.11.2.1: Proposed annual fish release levels (approximate number) by life stage and location.

Age Class	Max. No.	Size (fpp)	Release Date	Location		
				Stream	Release Point (RKm)	Major Watershed
Yearling	481,000	7.0	Apr - May	Lower Cowlitz	66	Cowlitz
	118,000[a]	7.0	Apr - May	Lower Cowlitz	66	Cowlitz
	48,000[b]	7.0	Apr - May	Lower Cowlitz	66	Cowlitz

[a] Upper Cowlitz stock.
[b] Tilton River (WRIA 26.0560) stock.
Source: WDFW FBD 2014.

1.12 Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

Specific harvest rates for each group of hatchery steelhead are unknown, (because both groups are adipose fin clipped), however, punch card estimates for total harvest of marked hatchery steelhead are available by month for all areas open to sport harvest. Total catch of early- and late-winter steelhead are combined.

Table 1.12.1: Returns of Winter Steelhead to the Cowlitz Hatchery Complex, 2002-2008.

Return Year	Hatchery Return	Hatchery- Origin Fish Released Upstream*	Natural- Origin Fish Released Upstream*
2002	5,424	1,354	766
2003	4,391	1,433	523
2004	2,952	834	296
2005	1,758	300	280
2006	2,468	310	544
2007	2,166	353	622
2008	2,310	340	517
Average	**3,067**	**703**	**507**

*Includes all winter steelhead returning to the Cowlitz Hatchery Complex.
Source: Hatcheries Headquarters Database 2014.

Table 1.12.2: Returns of Winter-late Steelhead to the Cowlitz Salmon Hatchery 2008-2011.

Return Year	Winter-Late, Lower Program	Winter Program (Discontinued)	Hatchery-Origin Fish Released Upstream*	Natural- Origin Fish Released Upstream*
2008	2,310	1,036	340	517
2009	6,072	1,971	2,689	513
2010	8,975	2,015	6	614
2011	5,806	1,652	19	627
Average	**5,791**	**1,669**	**764**	**568**

*Includes all winter steelhead returning to the Cowlitz Hatchery Complex.
Source: Hatcheries Headquarters Database 2014.

Table 1.12.3: Returns of Winter-late Steelhead to the Cowlitz Hatchery Complex, 2012-2014. Source: Hatcheries Headquarters Database 2014.

Return Year	Lower Program	Upper Program	Tilton Program	Hatchery-Origin Fish Released Upstream*	Natural-Origin Fish Released Upstream*
2012	6,643	668	325	NA	580
2013	3,459	418	461	NA	343
2014	4,792	27	327	NA	NA
Average	**5,437**	**371**	**371**	**NA**	**462**

*Includes all winter steelhead returning to the Cowlitz Hatchery Complex. First returns for the Upper and Tilton programs will be winter/spring of 2015.
NA- Data not available
Source: Hatcheries Headquarters Database 2014.

See also Table 3.3.1.1.

1.13 Date program started (years in operation), or is expected to start.

Sub-yearling plants were made in the early-1990s; yearling plants started in 1995.

1.14 Expected duration of program.

Winter-late steelhead production from CTH is part of the continued operation of the Cowlitz River Hydroelectric Project, FERC Project No. 2016, operated under the new license with an effective date of July 18, 2003. The license is for a term of 35 years and expires July 18, 2038.

1.15 Watersheds targeted by program.

Cowlitz/Lower Columbia

1.16 Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

1.16.1 Brief Overview of Key Issues.

The total lower Cowlitz steelhead program is comprised of around 480,000 winter-late smolts at 7 fish per pound (fpp) and 650,000 non-indigenous summer steelhead smolts at around 5.5 fpp released in the lower Cowlitz. A target of 118,000 and 48,000 winter-late steelhead smolts will be released through the upper Cowlitz and Tilton programs, respectively (FHMP update 2011). The key issues of the winter-late steelhead hatchery program are the impacts of smolts releases on lower river listed Chinook, coho and winter-late steelhead. Listed fish may be encountered during adult collection at the Cowlitz Salmon Hatchery separator unit, with both hatchery and natural-origin fish collected, sorted, held and distributed to various programs.

All releases are made below the Cowlitz River Barrier Dam downstream of the Tilton River/Lake Mayfield system and the upper Cowlitz system above Lake Scanewa. Significant reintroduction and

recovery programs for fall and spring Chinook and coho salmon along with winter steelhead and sea run cutthroat have been ongoing in those areas since 1996. Natural production from upriver areas are collected at the Cowlitz Falls Fish Facility (CFFF) and released as smolts from the salmon hatchery after acclimating in the stress relief ponds. Smolts of all wild fish range from 101.7 – 199.2 mm fl depending on species (Serl and Morrill 2004). By this time, the upriver production is at a size and condition indicating rapid emigration from the lower river. Releases occur at Blue Creek (WRIA 26.0527) where intense bank pressure congregates at the main "clay bank hole" and below the junction of Blue Creek and the river. The Cowlitz Trout Hatchery boat ramp provides access to the river in the Blue Creek vicinity. The purpose of the release of the late stock steelhead into the Cowlitz River is to continue a later timed steelhead while eliminating a directed harvest on wild winter steelhead. Adults are trapped, spawned and incubated at CSH. All wild winters not retained for broodstock are prioritized to the upper river system.

1.16.2 Potential Alternatives to the Current Program

Alternative 1: *Eliminate the program*: This action would reduce potential interaction with the natural population and eliminate potential impacts on other ESA-listed species. Currently this program supports a very popular late winter/spring sport fishery, and is consistent with the FERC mitigation responsibility requirements.

Alternative 2: Reduce the program: Program was increased to current when the early winter non-endemic program was discontinued. This was done to reduce risks to the native population.

Alternative 3: Use non-endemic stock: Based on genetic results returning to the early winter stock would not be consistent with the SSMP or HSRG guidelines.

1.16.3 Potential Reforms and Investments.

Reform/Investment 1: *Eliminate the program.* There would be negative region-wide impacts to eliminating the program. Angling restrictions would likely become more restrictive to protect any wild winter run fish in the Cowlitz system or in other neighboring systems due to the increase in pressure. Evaluating the impact would require funding.

2 SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS. (USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A)

2.1 List all ESA permits or authorizations in hand for the hatchery program.

None currently. This HGMP is submitted to the NOAA Fisheries for ESA consultation and take prohibition exemption under ESA section 4(d) or 10.

2.2 Provide descriptions, status, and projected take actions and levels for NMFS ESA-listed natural populations in the target area.

2.2.1 Description of NMFS ESA-listed salmonid population(s) affected by the program.

- Identify the NMFS ESA-listed population(s) that will be directly affected by the program.

Lower Columbia River steelhead (*Oncorhynchus mykiss*). Listed as a threatened species on March 19, 1998 (63FR13347); threatened status reaffirmed on January 5, 2006 (70FR37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

- Identify the NMFS ESA-listed population(s) that may be incidentally affected by the program.

Lower Columbia River Chinook (*Oncorhynchus tshawytscha*). Listed as "threatened" on March 24, 1999 (64FR14308); threatened status reaffirmed on June 28, 2005 (70FR37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

Lower Columbia River coho (*Oncorhynchus kisutch*). Identified as a candidate species on June 25, 1995 (60FR38011). Listed as threatened on June 28, 2005 (70FR37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

Columbia River chum salmon (*Oncorhynchus keta*). Listed as threatened on March 25, 1999 (64FR14507); threatened status reaffirmed on June 28, 2005 (70FR37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

2.2.2 Status of NMFS ESA-listed salmonid population(s) affected by the program.

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds.

Lower Columbia River Chinook: In Washington, the LCR Chinook ESU includes all naturally spawned Chinook populations from the mouth of the Columbia to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River, as well as fifteen artificial propagation programs. Excluded are Upper Columbia River bright hatchery stocks that spawn in the mainstem Columbia River below Bonneville Dam and in other tributaries upstream from the Sandy River to the Hood and White Salmon rivers (NMFS 2014 79FR20802). Spring Chinook were present historically in the Cowlitz, Kalama, Hood, White Salmon and Lewis rivers.

Status: Today only two of 32 historical populations – the North Fork Lewis and Sandy late-fall populations – are considered viable. Most populations (26 out of 32) have a very low probability of persistence over the next 100 years, and some populations are extirpated, or nearly so. Five of the six strata fall significantly short of the Willamette- Lower Columbia Technical Recovery Team (WLC TRT) criteria for viability. One stratum – Cascade late fall – meets the WLC TRT criteria (Dornbush and Sihler 2013). Dam construction eliminated habitat for a number of populations leading to the extirpation of spring Chinook salmon populations in the Upper Cowlitz, Cispus, Tilton, North Fork Lewis , Big White Salmon rivers, and fall Chinook populations in the Upper Cowlitz and Big White Salmon rivers (SHIEER, NMFS 2004). Projects to allow access have been initiated in the Cowlitz and Lewis systems but these are not close to producing self-sustaining populations; Condit Dam on the Big White Salmon River was breached October 26, 2011. Based on the 2010 recovery plan analyses, all of the 14 Tule populations (**Table 2.2.2.1**) are considered very high risk except one that is considered at high risk. The modeling conducted in association with Tule harvest management suggests that three of the populations (Coweeman, Lewis and Washougal) are at a somewhat lower risk (LCFRB 2010).

Table 2.2.2.1: Baseline viability status, viability and abundance objectives, and productivity improvement targets for lower Columbia River Chinook populations.

		Baseline viability					Prod.	Abundance		
Population	Contribution	A&P	S	D	Net	Obj.	target	Historical	Baseline	Target
Coast Fall										
Grays/Chinook	Contributing[2]	VL	H	VL	VL[2]	M+	+500%	800	<50	1,000
Eloch/Skam [C]	Primary	VL	H	L	VL[2]	H	+150%	3,000	<50	1,500
Mill/Aber/Germ	Primary[1]	VL	H	L	VL[2]	H	+155%	2,500	50	900
Youngs Bay (OR)	Stabilizing	--[3]	--[3]	--[3]	L	L	--[3]	--[3]	--[3]	--[3]
Big Creek (OR) [C]	Contributing[1]	--[3]	--[3]	--[3]	VL	L	--[3]	--[3]	--[3]	--[3]
Clatskanie (OR)	Primary	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Scappoose (OR)	Primary[1]	--[3]	--[3]	--[3]	L	H	--[3]	--[3]	--[3]	--[3]
Cascade Fall										
Lower Cowlitz [C]	Contributing	VL	H	M	VL[2]	M+	+50%	24,000	500	3,000
Upper Cowlitz	Stabilizing	VL	VL	M	VL	VL	--	28,000	0	--
Toutle[C]	Primary[1]	VL	H	M	VL[2]	H+	+265%	11,000	<50	4,000
Coweeman [G]	Primary	VL	H	H	VL[2]	H+	+80%	3,500	100	900
Kalama	Contributing[2]	VL	H	M	VL[2]	M	+110%	2,700	<50	500
Lewis [G]	Primary	VL	H	H	VL[2]	H+	+280%	2,600	<50	1,500
Salmon	Stabilizing	VL	H	M	VL	VL	--	n/a	<50	--
Washougal	Primary	VL	H	M	VL[2]	H+	+190%	2,600	<50	1,200
Clackamas (OR) [C]	Contributing	--[3]	--[3]	--[3]	VL	M	--[3]	--[3]	--[3]	--[3]
Sandy (OR)	Contributing[1]	--[3]	--[3]	--[3]	VL	M	--[3]	--[3]	--[3]	--[3]
Cascade L Fall										
Lewis NF [C,G]	Primary	VH	H	H	VH[1]	VH	0%	23,000	7,300	7,300
Sandy (OR) [C,G]	Primary	--[3]	--[3]	--[3]	H	VH	--[3]	--[3]	--[3]	--[3]
Cascade Spring										
Upper Cowlitz [C,G]	Primary	VL	L	M	VL[2]	H+	>500%	22,000	300	1,800
Cispus [C,G]	Primary	VL	L	M	VL[2]	H+	>500%	7,800	150	1,800
Tilton	Stabilizing	VL	VL	VL	VL	VL	0%	5,400	<100	--
Toutle	Contributing	VL	H	L	VL	M	>500%	3,100	100	1,100
Kalama	Contributing[2]	VL	H	L	VL	L	>500%	4,900	100	300
Lewis NF [C]	Primary	VL	L	M	VL	H	>500%	15,700	300	1,500
Sandy (OR) [C,G]	Primary	--[3]	--[3]	--[3]	M	H	--[3]	--[3]	--[3]	--[3]
Gorge Fall										
L. Gorge (WA/OR)	Contributing	VL	M	L	VL[2]	M	>500%	n/a	<50	1,200
U. Gorge (WA/OR) [C]	Contributing[1]	VL	M	L	VL[2]	M	>500%	n/a	<50	1,200
White Salmon [C]	Contributing	VL	L	L	VL	M	>500%	n/a	<50	500
Hood (OR)	Primary[4]	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Gorge Spring										
White Salmon [C]	Contributing	VL	VL	VL	VL	L+	>500%	n/a	<50	500
Hood (OR)	Primary	--[3]	--[3]	--[3]	VL	VH	--[3]	--[3]	--[3]	--[3]

Source: LCFRB 2010.
L = Low; M = Moderate; H = High; VH/E = Very High/Extinct.
[1] Increase relative to interim Plan.
[2] Reduction relative to interim Plan.
[3] Addressed in Oregon Management Unit plan.
[C] Designated as a historical core population by the TRT.
[G] Designated as a historical legacy population by the TRT.

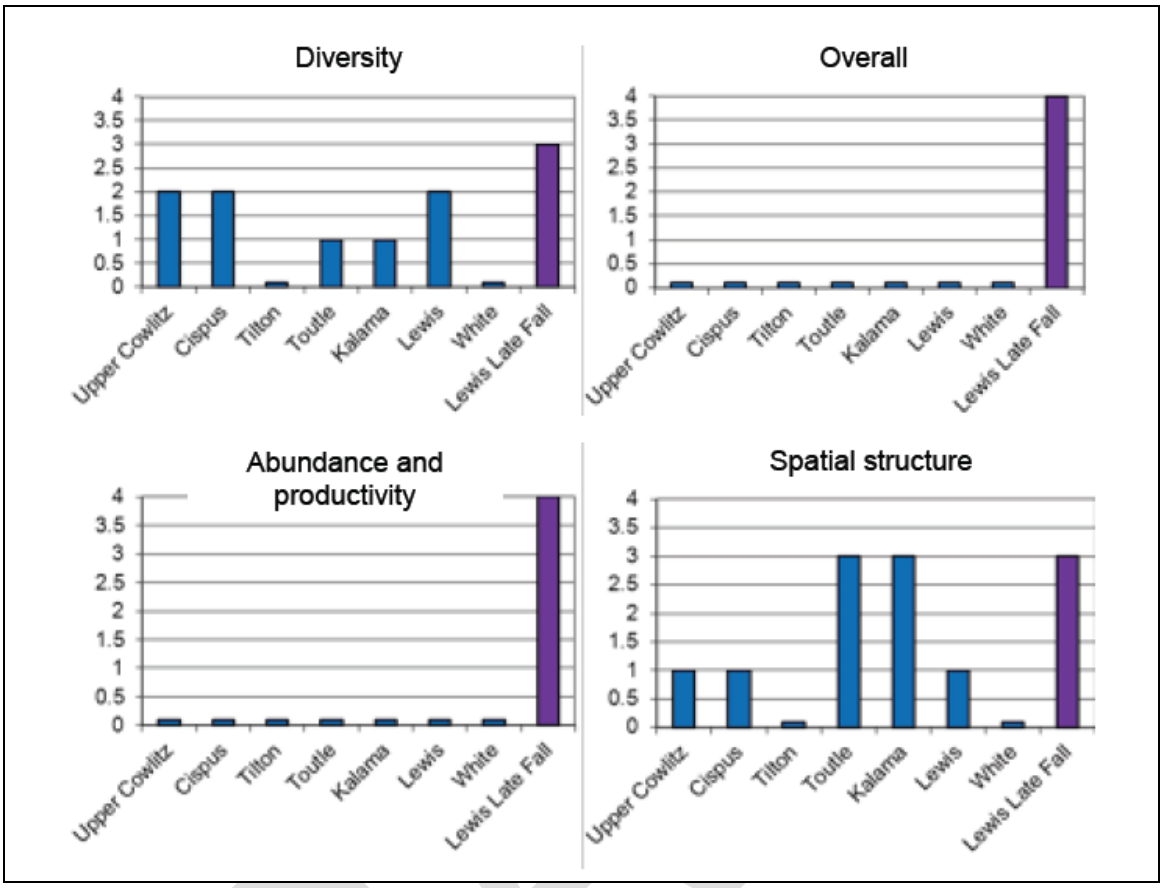


Figure 2.2.2.1: Current status of Washington lower Columbia River spring Chinook and late fall-run (bright) Chinook salmon populations for the VSP parameters and overall population risk. (LCFRB Recovery Plan 2010, chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

Lower Columbia River Steelhead *(Oncorhynchus mykiss)*: The DPS includes all naturally spawned anadromous *O. mykiss* (steelhead) populations below natural and manmade impassable barriers in streams and tributaries to the Columbia River between the Cowlitz and Wind Rivers, Washington (inclusive), and the Willamette and Hood Rivers, Oregon (inclusive), and excludes fish originating from the upper Willamette River Basin above Willamette Falls. The DPS includes seven artificial propagation programs, including the Cowlitz Trout Hatchery Winter-late (Lower Cowlitz), Kalama River Wild (winter- and summer-run) and Lewis River Wild Winter (NMFS 2014 79FR20802).

Status: Today, 16 of the 23 Lower Columbia River steelhead populations have a low or very low probability of persisting over the next 100 years, and six populations have a moderate probability of persistence. Only the summer-run Wind population is considered viable. All four strata in the DPS fall short of the WLC TRT criteria for viability (Dornbush and Sihler 2013). Populations in the upper Lewis and Cowlitz watersheds remain cut-off from access to essential spawning habitat by hydroelectric dams. Projects to allow access have been initiated in the Cowlitz and Lewis systems but these have not yet produced self-sustaining populations (Ford 2011). Condit Dam on the White Salmon River was breached October 26, 2011. WDFW is currently developing watershed-specific management plans in accordance with the SSMP. As part of this planning process, WDFW is proposing to complete a thorough review of current steelhead stock status using the most up to date estimates of adult abundance, juvenile production and genetic information.

Table 2.2.2.2: Baseline viability status, viability and abundance objectives, and productivity improvement targets for lower Columbia River steelhead populations.

		Baseline viability					Prod.	Abundance		
Population	Contribution	A&P	S	D	Net	Obj.	target	Historical	Baseline	Target
Coast Winter										
Grays/Chinook	Primary	VH	VH	M	M[1]	H	0%[4]	1,600	800	800
Eloch/Skam	Contributing	VH	VH	M	M[1]	M+	0%[4]	1,100	600	600
Mill/Ab/Germ	Primary	H	VH	M	M[1]	H	0%[4]	900	500	500
Youngs Bay (OR)	Primary	--[3]	--[3]	--[3]	VH	VH	--[3]	--[3]	--[3]	--[3]
Big Creek (OR)	Primary	--[3]	--[3]	--[3]	H	VH	--[3]	--[3]	--[3]	--[3]
Clatskanie (OR)	Primary	--[3]	--[3]	--[3]	VH	VH	--[3]	--[3]	--[3]	--[3]
Scappoose (OR)	Primary	--[3]	--[3]	--[3]	VH	VH	--[3]	--[3]	--[3]	--[3]
Cascade Winter										
Lower Cowlitz	Contributing	L	M	M	L	M	+5%	1,400	350	400
Upper Cowlitz [C,G]	Primary	VL	M	M	VL[2]	H[1]	>500%	1,400	<50	500
Cispus [C,G]	Primary	VL	M	M	VL[2]	H[1]	>500%	1,500	<50	500
Tilton	Contributing	VL	M	M	VL	L	>500%	1,700	<50	200
S.F. Toutle	Primary	M	VH	H	M	H+	+35%	3,600	350	600
N.F. Toutle [C]	Primary	VL	H	H	VL[2]	H	+125%		120	600
Coweeman	Primary	L	VH	VH	L[2]	H	+25%	900	350	500
Kalama	Primary	L	VH	H	L[2]	H+	+45%	800	300	600
N.F. Lewis [C]	Contributing	VL	M	M	VL[2]	M	>500%	8,300	150	400
E.F. Lewis	Primary	M	VH	M	M[1]	H	+25%	900	350	500
Salmon	Stabilizing	VL	H	M	VL[2]	VL	0%	na	<50	--
Washougal	Contributing	L	VH	M	L[2]	M	+15%	800	300	350
Clackamas (OR) [C]	Primary	--[3]	--[3]	--[3]	M	H	--[3]	--[3]	--[3]	--[3]
Sandy (OR) [C]	Primary	--[3]	--[3]	--[3]	L	VH	--[3]	--[3]	--[3]	--[3]
Cascade Summer										
Kalama [C]	Primary	H	VH	M	M[1]	H	0%[4]	1,000	500	500
N.F. Lewis	Stabilizing	VL	VL	VL	VL	VL	0%	na	150	--
E.F. Lewis [G]	Primary	VL	VH	M	VL[2]	H	>500%	600	<50	500
Washougal [C,G]	Primary	M	VH	M	M[1]	H	+40%	2,200	400	500
Gorge Winter										
L. Gorge (WA/OR)	Primary	L	VH	M	L[2]	H	+45%	na	200	300
U. Gorge (WA/OR)	Stabilizing	L	M	M	L[2]	L	0%	na	200	--
Hood (OR) [C,G]	Primary	--[3]	--[3]	--[3]	M	H	--[3]	--[3]	--[3]	--[3]
Gorge Summer										
Wind [C]	Primary	VH	VH	H	H[1]	VH	0%[4]	na	1,000	1,000
Hood (OR)	Primary	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]

Source: LCFRB 2010.
L = Low; M = Moderate; H = High; VH/E = Very High/Extinct.
[1] Increase relative to interim Plan.
[2] Reduction relative to interim Plan.
[3] Addressed in Oregon Management Unit plan.
[4] Improvement increments are based on abundance and productivity; however, this population will require improvement in spatial structure or diversity to meet recovery objectives.
[C] Designated as a historical core population by the TRT.
[G] Designated as a historical legacy population by the TRT.

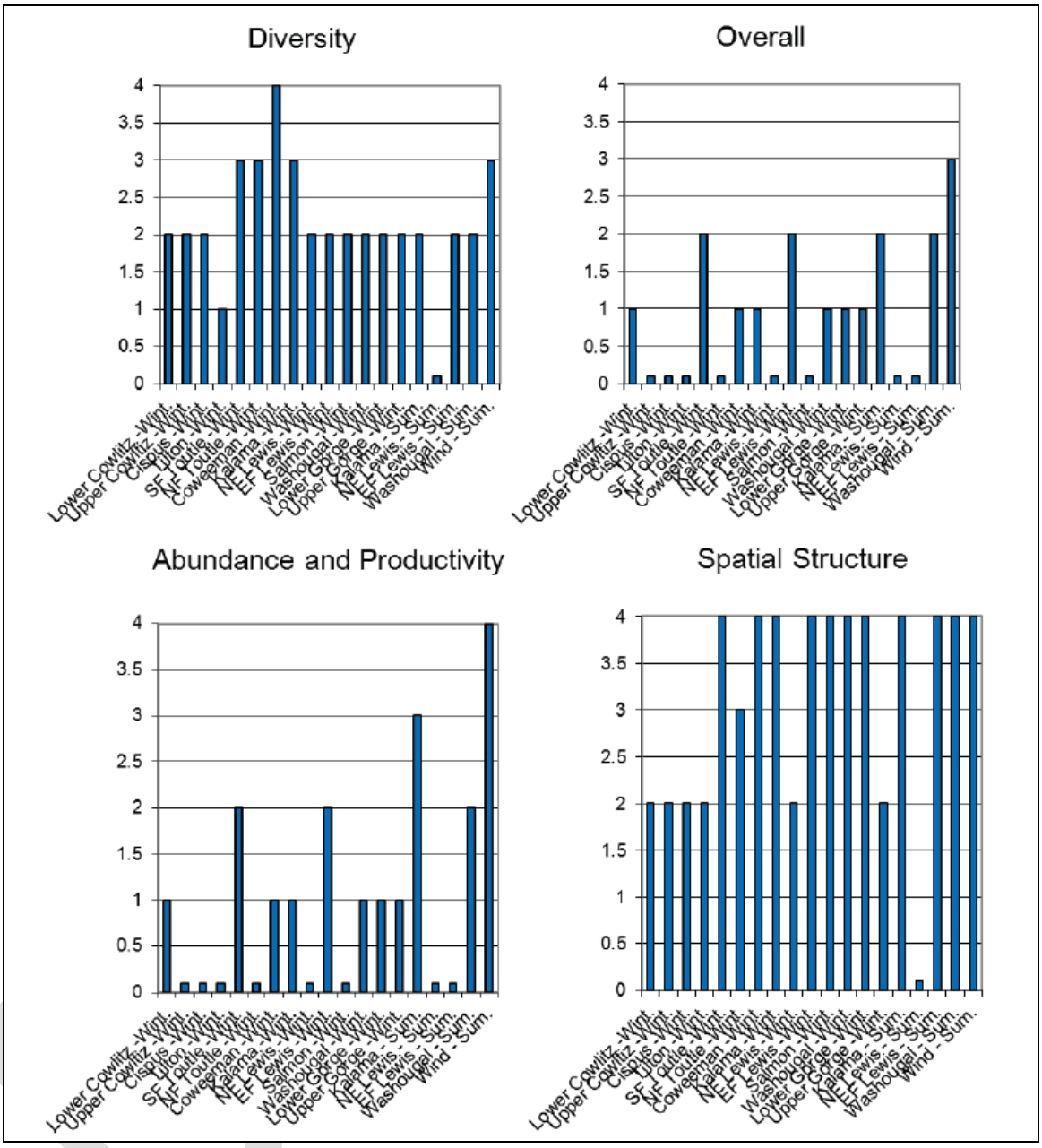


Figure 2.2.2.2: Current status of Washington LCR steelhead populations for the VSP parameters and overall population risk. (LCFRB 2010 Recovery Plan, chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

Lower Columbia River coho *(Oncorhynchus kisutch)*: Originally part of a larger Lower Columbia River/Southwest Washington ESU, Lower Columbia coho were identified as a separate ESU and listed as threatened on June 28, 2005. The ESU includes all naturally spawned populations of coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia up to and including the Big White Salmon and Hood Rivers. The twenty-one artificial propagation programs include: the Grays River, Peterson Coho Project, Cowlitz Type-N Coho Program in the Upper and Lower Cowlitz Rivers, Cowlitz Game and Anglers Coho Program, Friends of the Cowlitz Coho Program, North Fork Toutle River Hatchery, Kalama River Type-N and Type-S Coho Programs, Lewis River Type-N and Type-S

Coho programs, Fish First Wild Coho and Type-N Coho programs, Syverson Project Type-N Coho Program, and Washougal Hatchery Type-N Coho Program (NMFS 2014 79FR20802).

Status: Status evaluations of LCR coho status, all based on WLC-TRT criteria, have been conducted since the last BRT status update in 2005 (McElhany et al. 2007, Beamesderfer et al. 2010, LCFRB 2010, Dornbusch and Sihler 2013). All of these evaluations concluded that the ESU is currently at very high risk of extinction. All of the Washington side populations are considered at very high risk, although uncertainty is high because of a lack of adult spawner surveys. The 2005 BRT evaluation noted that smolt traps indicate some natural production in Washington populations, though given the high fraction of hatchery origin spawners suspected to occur in these populations it is not clear that any are self-sustaining (Ford 2011). Since this time WDFW has implemented an ESU wide monitoring program for LCR coho which began in 2010. Preliminary results indicate that natural origin population abundance may be higher than previously thought for certain populations (WDFW, unpublished). Results from the first 3 years of monitoring should be available in the near future. Currently, 21 of the 24 Lower Columbia River coho salmon populations are considered to have a very low probability of persisting over the next 100 years, and none is considered viable (Dornbusch and Sihler 2013). All three strata in the ESU fall significantly short of the WLC TRT criteria for viability.

Table 2.2.2.3: Baseline viability status, viability and abundance objectives, and productivity improvement targets for lower Columbia River coho populations.

		Baseline viability					Prod.	Abundance		
Population	Contribution	A&P	S	D	Net	Obj.	target	Historical	Baseline	Target
Coast										
Grays/Chinook [L]	Primary	VL	H	VL	VL[2]	H	+370%	3,800	<50	2,400
Eloch/Skam [L]	Primary	VL	H	VL	VL[2]	H	+170%	6,500	<50	2,400
Mill/Ab/Germ [L]	Contributing	VL	H	L	VL[2]	M	>500%	2,800	<50	1,800
Youngs (OR) [L]	Stabilizing	--[3]	--[3]	--[3]	VL	VL	--[3]	--[3]	--[3]	--[3]
Big Creek (OR) [L]	Stabilizing[2]	--[3]	--[3]	--[3]	VL	VL	--[3]	--[3]	--[3]	--[3]
Clatskanie (OR) [L]	Primary[1]	--[3]	--[3]	--[3]	L	VH	--[3]	--[3]	--[3]	--[3]
Scappoose (OR) [L]	Primary	--[3]	--[3]	--[3]	M	VH	--[3]	--[3]	--[3]	--[3]
Cascade										
Lower Cowlitz [L]	Primary	VL	M	M	VL[2]	H	+100%	18,000	500	3,700
Upper Cowlitz [E, L]	Primary[1]	VL	M	L	VL	H[1]	>500%	18,000	<50	2,000
Cispus [E, L]	Primary[1]	VL	M	L	VL	H[1]	>500%	8,000	<50	2,000
Tilton [E, L]	Stabilizing[2]	VL	M	L	VL	VL[2]	0%	5,600	<50	--
Toutle SF [E, L]	Primary	VL	H	M	VL[2]	H	+180%	27,000	<50	1,900
Toutle NF [E, L]	Primary	VL	M	L	VL[2]	H	+180%		<50	1,900
Coweeman [L]	Primary	VL	H	M	VL[2]	H	+170%	5,000	<50	1,200
Kalama [L]	Contributing	VL	H	L	VL[2]	L	>500%	800	<50	500
NF Lewis [E, L]	Contributing	VL	L	L	VL[2]	L	+50%	40,000	200	500
EF Lewis [E, L]	Primary	VL	H	M	VL[2]	H	>500%	3,000	<50	2,000
Salmon [L]	Stabilizing	VL	M	VL	VL	VL	0%	na	<50	--
Washougal [L]	Contributing	VL	H	L	VL[2]	M+	>500%	3,000	<50	1,500
Clackamas (OR) [E, L]	Primary	--[3]	--[3]	--[3]	M	VH	--[3]	--[3]	--[3]	--[3]
Sandy (OR) [E, L]	Primary	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Gorge										
L Gorge (WA/OR) [L]	Primary	VL	M	VL	VL[2]	H	+400%	na	<50	1,900
U Gorge (WA) [L]	Primary[1]	VL	M	VL	VL[2]	H	+400%	na	<50	1,900
U Gorge/Hood (OR)[E]	Contributing[4]	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]

Source: LCFRB 2010.
L = Low; M = Moderate; H = High; VH/E = Very High/Extinct.
[1] Increase relative to interim Plan.
[2] Reduction relative to interim Plan.
[3] Addressed in Oregon Management Unit plan.
[4] Improvement increments are based on abundance and productivity; however, this population will require improvement in spatial structure or diversity to meet recovery objectives.
[E] Early run (Type S) coho stock.
[L] Late run (Type N) coho stock.
(Core and Legacy populations not designated by the TRT for coho).

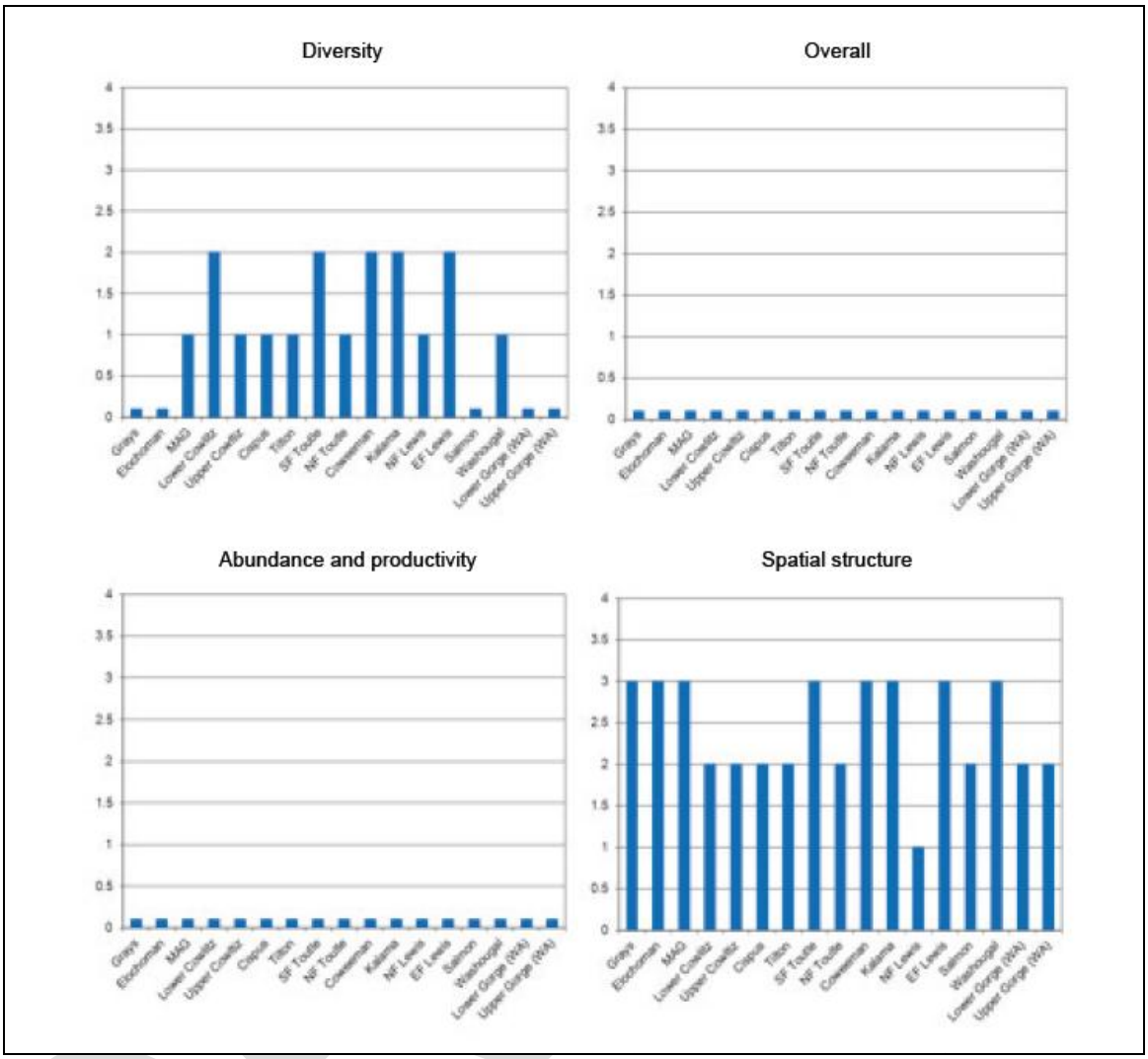


Figure 2.2.2.3: Current status of Washington LCR coho populations for the VSP parameters and overall population risk. (LCFRB 2010 recovery plan, chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

Columbia River chum salmon (*Oncorhynchus keta*). ESU includes all naturally spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon, as well as artificial propagation programs at Grays River and Washougal River/Duncan Creek chum hatchery programs (NMFS 2014 79FR20802).

Status: The LCFRB completed a revision recovery plan in 2010 that includes Washington populations of Columbia River chum salmon. This plan includes an assessment of the current status of Columbia River chum populations, which relied and built on the viability criteria developed by the WLC-TRT (McElhany et al. 2006) and an earlier evaluation of Oregon WLC populations (McElhany et al. 2007). This evaluation assessed the status of populations with regard to the VSP parameters of A/P, spatial structure, and diversity (McElhany et al. 2000). The result of this analysis is shown in **Figure 2.2.2.3**. The analysis indicates that all of the Washington populations with two exceptions are in the overall very high risk category (also described as extirpated or nearly so). The Grays River population was considered to be at moderate risk and the Lower Gorge population to be at low risk. The very high risk status assigned to the majority of Washington populations (and all the Oregon populations) reflects the very low abundance observed in these populations (e.g., <10 fish/year) (Ford 2011). Today, 15

of the 17 populations that historically made up this ESU are so depleted that either their baseline probability of persistence is very low or they are extirpated or nearly so; this is the case for all six of the Oregon populations. Currently almost all natural production occurs in just two populations: Grays/Chinook and the Lower Gorge. All three strata in the ESU fall significantly short of the WLC TRT criteria for viability (Dornbush and Sihler 2013).

Table 2.2.2.4: Baseline viability status, viability and abundance objectives, and productivity improvement targets for lower Columbia River chum populations.

		Baseline viability					Prod.	Abundance		
Population	Contribution	A&P	S	D	Net	Obj.	target	Historical	Baseline	Target
Coast										
Grays/Chinook [C,G]	Primary	VH	M	H	M[1]	VH	0%[4]	10,000	1,600	1,600
Eloch/Skam [C]	Primary	VL	H	L	VL[2]	H	>500%	16,000	<200	1,300
Mill/Ab/Germ	Primary	VL	H	L	VL	H	>500%	7,000	<100	1,300
Youngs (OR) [C]	Stabilizing[2]	--[3]	--[3]	--[3]	VL	VL	--[3]	--[3]	--[3]	--[3]
Big Creek (OR) [C]	Stabilizing[2]	--[3]	--[3]	--[3]	VL	VL	--[3]	--[3]	--[3]	--[3]
Clatskanie (OR)	Primary[1]	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Scappoose (OR)	Primary[1]	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Cascade										
Cowlitz (Fall) [C]	Contributing	VL	H	L	VL	M	>500%	195,000	<300	900
Cowlitz (Summer) [C]	Contributing	VL	L	L	VL	M	>500%	n/a	n/a	900
Kalama	Contributing	VL	H	L	VL	M	>500%	20,000	<100	900
Lewis [C]	Primary	VL	H	L	VL	H	>500%	125,000	<100	1,300
Salmon	Stabilizing	VL	L	L	VL	VL	0%	n/a	<100	--
Washougal	Primary	VL	H	L	VL[2]	H+	>500%	18,000	<100	1,300
Clackamas (OR) [C]	Contributing	--[3]	--[3]	--[3]	VL	M	--[3]	--[3]	--[3]	--[3]
Sandy (OR)	Primary	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Gorge										
L. Gorge (WA/OR) [C,G]	Primary	VH	H	VH	H[1]	VH	0%[4]	6,000	2,000	2,000
U. Gorge (WA/OR)	Contributing	VL	L	L	VL	M	>500%	11,000	<50	900

Source: LCFRB 2010.
L = Low; M = Moderate; H = High; VH/E = Very High/Extinct.
[5] Increase relative to interim Plan.
[6] Reduction relative to interim Plan.
[7] Addressed in Oregon Management Unit plan.
[8] Improvement increments are based on abundance and productivity; however, this population will require improvement in spatial structure or diversity to meet recovery objectives.
[C] Designated as a historical core population by the TRT.
[G] Designated as a historical legacy population by the TRT.

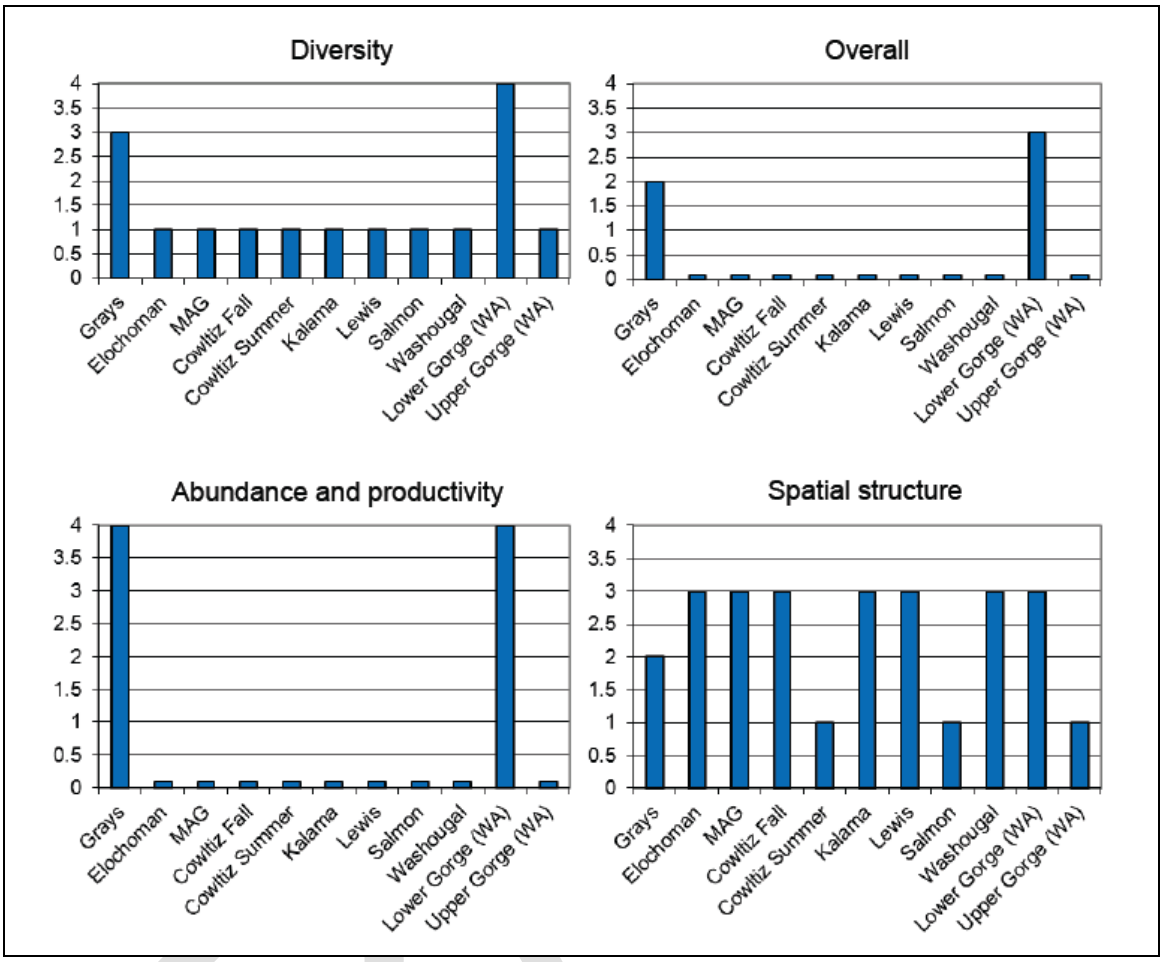


Figure 2.2.2.4: Current status of Washington CR chum populations for the VSP parameters and overall population risk. (LCFRB 2010 Recovery Plan, Chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population.

Juvenile coho production estimates is the one measure of production in the Lower Columbia system. See HGMP section 11.1 for planned M&E.

Table 2.2.2.5: Lower Columbia River Washington tributary coho smolt production estimates, 1997-2009 (WDFW, Region 5).

Year	Cedar Creek	Mill Creek	Abernathy Creek	Germany Creek	Cowlitz Falls Dam	Mayfield Dam
1997	-----	-----	-----	-----	3,700	700
1998	38,400	-----	-----	-----	110,000	16,700
1999	28,000	-----	-----	-----	15,100	9,700
2000	20,300	-----	-----	-----	106,900	23,500
2001	24,200	6,300	6,500	8,200	334,700	82,200
2002	35,000	8,200	5,400	4,300	166,800	11,900
2003	36,700	10,500	9,600	6,200	403,600	38,900
2004	37,000	5,700	6,400	5,100	396,200	36,100
2005	58,300	11,400	9,000	4,900	766,100	40,900
2006	46,000	6,700	4,400	2,300	370,000	33,600
2007	29,300	7,000	3,300	2,300	277,400	34,200
2008	36,340	90,97	5,077	3,976	-----	38,917
2009	61,140	62,83	3,761	2,576	-----	29,718
2010	-----	-----	-----	-----	-----	49,171
2011	-----	-----	-----	-----	-----	43,831

Source: LCR FMEP Annual Report 2010 and WDFW Data 2012.

- Provide the most recent 12 year annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Table 2.2.2.6: Spring Chinook salmon total spawner abundance estimates in LCR tributaries, 2000-2012.

Year	Cowlitz	Kalama	Lewis
2000	266	34	523
2001	347	578	754
2002	419	898	498
2003	1,953	790	745
2004	1,877	358	529
2005	405	380	122
2006	783	292	857
2007	74	2,150	264
2008	425	364	40
2009	763	34	80
2010	711	0	160
2011	1,359	26	120
2012	1,359	28	200

Source: Joe Hymer, WDFW Annual Database 2012.

Table 2.2.2.7: Fall Chinook salmon total spawner abundance estimates in LCR tributaries, 2000-2011[a].

Year	Elochoman River	Coweeman River[a]	Grays River	Skamokawa Creek	Cowlitz River	Green River (Toutle)	SF Toutle River	Kalama River	EF Lewis River	NF Lewis River	Washougal River
2000	884	424	80	482	2,100	1,580	204	3,877	391	6,504	2,757
2001	230	251	104	3	1,979	1,081	102	3,451	245	4,281	1,704
2002	332	566	390	7	3,038	5,654	216	10,560	441	5,518	2,728
2003	2,204	753	149	529	2,968	2,985	327	9,272	607	11,519	2,678
2004	4,796	1,590	745	2,109	4,621	4,188	618	6,680	918	13,987	10,597
2005	6,820	1,090	387	588	10,329	13,846	140	24,782	727	18,913	3,444
2006	7,581	900	82	372	14,427	7,477	450	18,952	1,375	17,106	6,050
2007	194	140	99	36	2,724	961	30	1,521	308	10,934	2,143
2008	782	95	311	253	1,334	824	45	2,617	236	4,268	3,182
2009	231	147	93	139	2,156	1,302	66	4,356	110	6,112	2,995
2010	1,883	1,330	12	268	2,762	605	NE	3,576	314	8,908	4,529
2011	508	2,148	353	41	1,616	668	NE	10,639	334	14,033	2,961

Source: Ron Roler, WDFW Natural Spawn Progress Reports 2012.
* Estimates of total adult and jack fall Chinook. May include fish put upstream of hatchery weirs.

Table 2.2.2.8: Wild winter steelhead escapement estimates for select SW Washington DPS populations, current WDFW escapement goals and LCSRP abundance targets.

Location	Grays River	Elochoman/ Skamokawa	Mill/Abernathy/ Germany
WDFW Escapement Goal	**1,486**	**853**	**508**
LCSRP Abundance Target	**800**	**600**	**500**
2000	1,064	650	380
2001	1,130	656	458
2002	724	370	354
2003	1,200	668	342
2004	1,132	768	446
2005	396	376	274
2006	718	632	398
2007	724	490	376
2008	764	666	528
2009	568	222	396
2010	422	534	398
2011	318	442	270
3-year average	**436**	**399**	**355**
5-year average	**559**	**471**	**394**
10-year average	**697**	**517**	**378**

Source: WDFW Data 2012.

Table 2.2.2.9: Wild winter steelhead escapement estimates for select SW Washington DPS populations, current WDFW escapement goals and LCSRP abundance targets.

Location	Coweeman	SF Toutle	NF Toutle/ Green	Kalama	EF Lewis	Washougal
WDFW Escapement Goal	**1,064**	**1,058**	**NA**	**1,000**	**1,243**	**520**
LCSRP Abundance Target	**500**	**600**	**600**	**600**	**500**	**350**
2000	530	490	----	921	NA	NA
2001	384	348	----	1,042	377	216
2002	298	640	----	1,495	292	286
2003	460	1,510	----	1,815	532	764
2004	722	1,212	----	2,400	1,298	1,114
2005	370	520	388	1,856	246	320
2006	372	656	892	1,724	458	524
2007	384	548	565	1,050	448	632
2008	722	412	650	776	548	732
2009	602	498	699	1,044	688	418
2010	528	274	508	961	336	232
2011	408	210	416	622	308	204
3-year average	**513**	**327**	**541**	**876**	**444**	**285**
5-year average	**529**	**388**	**568**	**891**	**466**	**444**
10-year average	**487**	**648**	***588**	**1,374**	**515**	**523**

Source: WDFW Data 2012.
* 7-year average for NF Toutle/Green.

Table 2.2.2.10: Wild summer steelhead population estimates for LCR populations from 2001 to 2011, current WDFW escapement goals, and LCSRP abundance targets.

Location	Kalama	EF Lewis	Washougal	Wind
WDFW Escapement Goal	**1,000**	**NA**	**NA**	**1,557**
LCSRP Abundance Target	**500**	**500**	**500**	**1,000**
2001	286	271	184	457
2002	454	440	404	680
2003	817	910	607	1,096
2004	632	425	NA	861
2005	400	673	608	587
2006	387	560	636	632
2007	361	412	681	737
2008	237	365	755	614
2009	308	800	433	580
2010	370	602	787	788
2011	534	1,084*	956*	1,468
3-year average	**404**	**829**	**725**	**945**
5-year average	**362**	**653**	**722**	**837**
10-year average	**450**	**627**	**652**	**804**

Source: WDFW Data 2012.
* Preliminary estimates.

Table 2.2.2.11: Population estimates of chum salmon in the Columbia River.

Location	2002	2003	2004	2005	2006	2007	2008	2009	2010[a]	2011[a]
Crazy Johnson Creek	---	---	966	1,471	3,639	759	1,034	981	677	2,374
WF Grays River	---	---	9,015	1,324	1,232	1,909	800	994	1,967	7,002
Mainstem Grays River	---	---	4,872	1,400	1,244	1,164	886	750	3,467	1,848
I-205 area	3,468	2,844	2,102	1,009	862	544	626	1,132	2,105	4,947
Multnomah area	1,267	1,130	665	211	313	115	28	102	427	641
St Cloud area	---	137	104	92	173	9	1	14	99	509
Horsetail area	---	---	106	40	63	17	33	6	45	183
Ives area[b]	4,466	1,942	363	263	387	145	168	141	214	162
Duncan Creek[c]	13	16	2	7	42	9	2	26	48	85
Hardy Creek	343	392	49	73	104	14	3	39	137	173
Hamilton Creek	1,000	500	222	174	246	79	114	115	247	517
Hamilton Spring Channel	794	363	346	84	236	44	109	91	187	324
Grays return[d]	12,041	16,974	15,157	4,327	6,232	3,966	2,807	2,833	6,399	11,518
I-205 to Bonneville return	11,351	7,324	3,959	1,953	2,426	976	1,084	1,666	3,509	7,541
Lower Columbia River Total	23,392	24,298	19,116	6,280	8,658	4,942	3,891	4,499	9,908	19,059

Source: Todd Hillson - WDFW Chum Program 2012.

[a] Data for 2010 and 2011 is preliminary.

[b] Ives area counts are the carcass tagging estimate plus fish removed for broodstock, except for 2007 and 2008, which is area under the curve.

[c] Totals for Duncan Creek do not include broodstock brought in from mainstem spawning areas, adult trap catch or surveys below monitoring weirs only..

[d] Grays return totals include natural spawners and removed for broodstock.

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

The proportion of effective hatchery-origin spawners (pHOS) should be less than 30% of the naturally spawning population for this integrated program per HSRG guidelines (2009). Per the FHMP and ISIT process pHOS is estimated at 0.29. See also 3.3.1. Also see HGMP section 11.1 for planned M&E.

Table 2.2.12: Late-winter Steelhead Adults Transported to the Upper Cowlitz River Basin, 1996-present.

Year	Unmarked/Natural Production				From Marked Fry Plant				AD clipped Hatchery			
	F	M	Jx	Total	F	M	Jx	Total	F	M	Jx	Total
1997	12	22	0	34	14	5	0	19	1	0	0	1
1998	5	6	0	11	1	5	0	6	23	26	0	49
1999	24	15	13	52	29	10	3	42	49	6	8	63
2000	108	107	0	215	28	73	0	101	19	77	0	96
2001	133	125	37	295	71	122	20	213	70	124	27	221
2002	346	419	1	766	174	492	1	667	453	898	3	50
2003	316	205	2	523	335	241	0	576	933	497	3	1,433
2004	146	146	4	296	100	167	0	267	214	619	1	834
2005	132	148	0	280	77	34	0	111	191	109	0	300
2006	261	270	13	544	35	108	2	145	64	238	8	310
2007	309	304	9	622	132	145	1	278	123	228	2	353
2008	273	240	4	517	75	154	3	232	101	231	8	340
2009	260	252	1	513	139	213	2	354	908	1,722	59	2,689
2010	324	290	0	614	1	1	0	2	6	0	0	6
2011	321	306	0	627	0	0	0	0	13	6	0	19
2012	265	315	0	580								
2013	202	141	0	343								
Total	3,437	3,311	84	6,832	1,211	1,770	32	3,013	3,168	4,781	119	6,764

Source: John Serl, Cowlitz Falls Fish Facility Biologist, 2014.

2.2.3 Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take.

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

Describe hatchery activities: The following hatchery activities are identified in the ESA Section 7 Consultation "Biological Opinion on Artificial Propagation in the Columbia River Basin" (March 29, 1999). In other HGMPs provided to NOAA (Puget Sound, Upper Columbia), indirect takes from hatchery releases such as predation and competition is highly uncertain and dependent on a multitude of factors (i.e. data for population parameters - abundance, productivity and intra species competition) and although HGMPs discuss our current understanding of these effects, it is not feasible to determine indirect take (genetic introgression, density effects, disease, competition, predation) due to these activities. Broodstock collection activities will directly handle listed fish and will have "take" tables associated with direct broodstock collection or with listed fish lost during handling for release. These tables will occur at the end of this HGMP.

Broodstock Program:

Broodstock Collection: The Cowlitz Barrier Dam adult collection facility enables the program to discriminate all returning adult fish according to hatchery and natural origin fish, since the program fish releases are 100% marked. The ability to discriminate hatchery/natural origin fish assures the program/stock adheres to the proper integrated stock criteria, particularly populations in the upper Cowlitz River and tributaries. The program utilizes natural winter steelhead stock derived from adults returning to the Cowlitz Barrier Dam and lower river tributary weirs.

Genetic introgression: Winter-late steelhead are a local stock. Integration will incorporate natural-origin fish per FHMP (update 2011).

The Cowlitz Hatchery winter-early steelhead (non-native) showed the highest introgression level among the three stocks. Lower Cowlitz tributary natural-origin steelhead were genetically most similar to natural-origin steelhead in the Coweeman and Elochoman rivers, and were distinct from steelhead in the nearby Toutle River sub-basin. Introgression from hatchery stocks is a significant concern in recovery planning for the ESA-listed Lower Cowlitz population. For this reason, the winter-early steelhead program was terminated in 2012.

Rearing Program:

Operation of Hatchery Facilities: Facility operation impacts include water withdrawal, effluent, and intake compliance. Effluent at outfall areas is rapidly diluted with mainstem flows and operation is within permitted guidelines (NPDES guidelines).

Disease: Over the years, rearing densities, disease prevention and fish health monitoring have greatly improved the health of the hatchery programs. *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (IHOT 1995) Chapter 5 have been instrumental in reducing disease outbreaks. While pathogens occur and may affect fish in the wild, they are believed to go undetected, and are quickly removed through predation. Furthermore, while the Cowlitz Salmon or Cowlitz Trout hatcheries have been noted as potential sources of fish pathogens including bacterial kidney disease, *Ceratomyxa shasta*, and IHNV, these diseases are also present in the natural spawning populations (Tacoma Power 2000).

In addition, although pathogens may cause post release mortality in fish from hatcheries, there is little evidence that hatchery origin fish routinely infect natural populations of salmon and steelhead in the Pacific Northwest (Enhancement Planning Team 1986 and Stewart and Bjornn 1990). Prior to release, the health and condition of the hatchery population is established by the Cowlitz Fish Health Specialist. This is commonly done one to three weeks prior to release, and up

to six weeks on systems with pathogen-free water and little or no history of disease. Indirect take from disease is unknown.

Release:

Hatchery Production/Density-Dependent Effects: Current levels of hatchery production in the Cowlitz River Basin are undergoing ESA consultations between NOAA Fisheries and the WDFW. The total steelhead program would be comprised of approximately 644,000 indigenous winter steelhead, and 650,000 non-indigenous summer steelhead raised to a release size ranging from 5 to 8 fpp. Since 2012, releases of early winter non-local steelhead have been eliminated and winter-late steelhead have been increased.

Potential Cowlitz Hatchery steelhead predation and competition effects on listed salmonids and eulachon: Salmon and steelhead feed actively during their downstream migration (Becker 1973; Muir and Emmelt 1988; Sager and Glova 1988). Proposed annual production goal is around 644,000. Actively migrating steelhead smolts releases can begin on April 15, at 5.5 fpp (210 mm fl), although WDFW has been implementing a start date closer to May 1. Steelhead releases could encounter rearing and emigrating listed Chinook, steelhead and chum in the Cowlitz sub-basin and Columbia mainstem. Due to size differences between steelhead smolts and sub-yearlings, competition is probably low with regards to food and spatial preference between species and size. At 5.5 fpp (210 mm fl), potential predation on listed Chinook would be fish 62-64 mm fl and smaller. Smolts from on station releases in large river systems travel rapidly – migration rates of approximately 20 river miles per day were observed by steelhead smolts in the Cowlitz River (Harza 1999). Once in the lower Columbia River mainstem of tidal influence, Dawley et al (1984) found the average migration rates for sub-yearling chinook, yearling chinook, and coho salmon and steelhead, were 22, 18, 17, and 35 RKm daily respectively.

Table 2.2.3.1: Peak migration timing and average fork length (mm) of out-migrant juvenile Chinook, coho and steelhead captured in rotary screw traps on Mill, Germany and Abernathy creek, Lower Columbia River, 2008.

Stream	Chinook		Coho		Steelhead	
	Avg Size (mm)	Peak Migration	Avg Size (mm)	Peak Migration	Avg Size (mm)	Peak Migration
Mill Cr	37.0	Mar 10-Apr 13	104.2	Mar 17-23	154.5	Apr 28-May 4
Germany Cr	39.8	Mar 17-23	115.3	May 19-25	177.8	May 12-18
Abernathy Cr	37.9	Mar 31 – Apr 6	112.1	May 19-25	163.8	May 12-18

Source: Kinsel et al 2009.

Both juvenile and adult salmonids have been documented to feed on eulachon (Gustafson et al. 2010). Predation of eulachon by steelhead reared in this program may occur, however it is unknown to what degree such predation may occur.

Table 2.2.3.2: Annual smolt collection by species and origin at the Cowlitz Falls Fish Facility from 1997 through 2013.

	Chinook			Steelhead			Coho		Cutthroat	
	Sub-yearling		Unmarked							Total
Season	Hatchery[1]	Unmarked	Yearling	Hatchery	Natural	Unmarked[2]	Unmarked[3]	Unmarked	Unmarked	Smolt
2013		21,760	508			6,757		213,703	380	243,108
2012		23,165	28	0	1	981		10,504	152	34,831
2011	1,234	4,819	4	1	220	5,742		34,632	314	46,966
2010	21,690	10,121	45	7	3,256	9,324		110,378	485	155,306
2009	32,218	2,816	28	8,145	1,586	4,407		40,697	281	90,178
2008	13,870	1,135	10	12,200	837	2,664		14,315	185	45,216
2007	15,778	284	55	19,414	2,401	8,117		104,277	715	151,041
2006	35,997	5,330	54	19,747	1,768	9,585		74,228	738	147,447
2005	11,554	3,222	35	25,345	3,561	17,338		264,921	1,026	327,002
2004	21,195	8,382	20	18,714	5,042	11,276		128,148	718	193,495
2003	26,982	7,741	18	16,463	170	14,740		173,540	1,280	240,934
2002	20,733	5,595	0	591	23,162	5,247		55,029	990	111,347
2001	36,450		25	4,901	33,491	17,807		334,718	1,077	428,469
2000	32,704			89	16,404	17,023	106,880		1,343	174,443
1999	8,878			31	10,783	10,001	15,120		545	45,358
1998	14,917			22	25,921	15,691	109,974		888	167,413
1997	22,815			37	15,621	2,777	3,673		260	45,183
Total	317,015	94,370	830	125,707	144,224	159,477	235,647	1,559,090	11,377	2,647,737

1] 2004-08 numbers based on RV clipped fish captured. 2002 and 2003 based on relative size.

2] Unmarked fish from 2004 onward are assumed to be naturally produced. 2002 and 2003 unmarked numbers based on VIE marking a portion of fry plant. 1997-2001 numbers are a mix of unmarked hatchery fry plants and natural production.

3] Coho smolts from 1997-2000 were a mix of hatchery fry and natural production. Coho smolts from 2001 onward are naturally produced.

Source - Draft Annual Report for the Cowlitz Falls from 1997- 2013.

Residualism: WDFW steelhead programs are reared and released in a smolted condition. To achieve this, the following rearing parameters are followed:

- To maximize smolting characteristics and minimize residual steelhead, WDFW adheres to a combination of acclimation, volitional release strategies, and release guidelines (Tipping 2001).
- Condition factors, including a lean 0.90 to 0.99 K factor, and co-efficient of variation (CVs) of less than 10% are steelhead rearing parameters (see HGMP section 10.3).

Monitoring:

In 2008, WDFW began implementing changes to many of its segregated LCR steelhead programs as the result of development of the *Conservation and Sustainable Fisheries (C&SF) Plan* (WDFW 2010 draft). Through this plan, WDFW used AHA modeling, combined with the best-available estimates of key model assumptions, to adjust segregated program sizes to meet HSRG standards (see **Attachment #3**). Through this effort, WDFW realized that some assumptions of the AHA model (e.g. harvest rates) needed to be validated and actual gene flow/introgression (or pHOS) needed to be monitored. WDFW has since been reviewing existing monitoring programs for the purpose of identifying improvements that would allow for the validation of key assumptions in the AHA model. WDFW initiated implementation of new monitoring efforts and changes to existing monitoring effort in 2008 for the purpose of collecting data/samples that would address the aforementioned modeling assumption validation needs. Subsequent to implementation improvements to the monitoring program, WDFW began development of a study design to estimate actual gene flow/introgression. The following list provides examples of activities being conducted as part of the improved monitoring program:

- **Summer steelhead monitoring (existing)** – provides information on hatchery/wild proportions during tagging/snorkeling as part of a mark-recapture population abundance estimation methodology.

- **Winter steelhead monitoring (existing)** – redd based surveys to estimate abundance of wild winter steelhead populations in LCR tributaries.
- **Fish In Fish Out (FIFO) monitoring (existing) –** provides information on adult and juvenile production for life cycle monitoring – i.e. productivity.
- **Cowlitz Introgression study (new)** – evaluated introgression rates of early winter and early summer hatchery stocks into lower Cowlitz wild winter steelhead population. The Cowlitz River study evaluated the genetic relationship between naturally spawning winter steelhead in the lower Cowlitz River and three hatchery stocks: early summer-run, early winter-run and late winter (endemic Cowlitz River stock). The study found the natural-origin fish were genetically distinct from the hatchery fish; however there was evidence of introgression from the hatchery stocks. The early winter steelhead program showed the highest level of introgression. Since completion of the study, WDFW is proposing to move to a SNPs baseline for future studies/monitoring involving genetic introgression instead of the microsatellite baseline used in the Cowlitz analysis. More specifics on the study design have been added to HGMP section 11.
- **Creel Surveys/ Hooking Mortality Study(new) –** implemented on the Wind (hooking mortality), Washougal and SF Toutle (creel surveys) rivers to evaluate harvest, harvest rates (SF Toutle), wild steelhead interception rates and post release mortality rates during fisheries. Long-term vision is a comprehensive program with a rotating design that moves between key watersheds.
- **Genetic sample collection (new and existing)** – genetic samples are collected from adult wild steelhead populations and naturally produced steelhead smolts during summer steelhead monitoring, at winter steelhead trapping locations, during FIFO monitoring (smolts) and potentially during creel surveys. These samples and future sample collections may be valuable in assessing gene flow/introgression (HGMP section 11).

In February 2008, WDFW formally adopted a *Statewide Steelhead Management Plan* (SSMP) that guides statewide policies, strategies and actions pertaining to steelhead in Washington State. This plan calls for the development of regional watershed plans that further guide steelhead management at the local level. WDFW is currently developing regional watershed plans for all LCR steelhead populations. This process includes the development of stakeholder workgroups that provide input into the planning process. During this process, all current hatchery steelhead programs are being reviewed and evaluated for possible program improvements. Program improvements could include, but are not limited to, changes in smolt release numbers, changes in broodstock composition (e.g. converting to indigenous stock), and changes in fishery regulations to better protect adults and/or juveniles. Additionally, the SSMP calls for the development of a network of wild steelhead gene banks throughout the state and these gene banks will be implemented through the regional watershed steelhead management plan development process.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken and observed injury or mortality levels for listed fish.

Table 2.2.3.3 Disposition of Cowlitz unmarked (natural-origin) adult winter-late steelhead returning to the Cowlitz Hatchery Complex.

Brood Year	Plants	Trap/Holding Mortality	Surplus	Spawned	Total
2007	622	2	0	---	641
2008	517	0	0	---	507
2009	513	0	0	---	494
2010	614	1	0	---	613
2011	627	2	3	---	643

2012	580	15	2	127	782
2013	343	17	0	243	1,167
Average	**545**	**5**	**1**	**185**	**692**

Source: WDFW Hatcheries Headquarters Database 2014. John Serl, Cowlitz Falls Fish Facility Biologist, 2014.

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

See "take" tables at the end of this HGMP. The impacts from harvest are included in the FMEPs.

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

No situations are expected to occur where take would exceed ESA limits. If significant numbers of wild salmonids are observed impacted by this operation, then staff would inform the WDFW District Biologist, Fish Health Specialist or Area Habitat Biologist who, along with the Hatchery Complex Manager, would determine an appropriate plan and consult with NOAA-NMFS for adaptive management review and protocols.

Handling and release of wild steelhead in broodstock trapping operations is monitored and take observations have been rare. Any additionally mortality from this operation on a yearly basis would be communicated to Fish program staff for additional guidance.

3 SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1 Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

WDFW has several policies/plans that help inform management decisions regarding the HGMPs currently under review. These policies include:

1. Hatchery and Fishery Reform Policy (Commission Policy C3619)
2. The Statewide Steelhead Management Plan (SSMP)
3. The Conservation and Sustainable Fisheries Plan (draft)
4. The Hatchery Action Implementation Plans (HAIP)
5. Lower Columbia Salmon Recovery Plan (LCSRP)

Descriptions of these policies and excerpts are shown below:

Policies/Plans – Key Excerpts

Hatchery and Fishery Reform Policy: Washington Department of Fish and Wildlife Commission Policy C-3619. WDFW adopted the Hatchery and Fishery Reform Policy C-3619 in 2009. Its purpose is to advance the conservation and recovery of wild salmon and steelhead by promoting and guiding the implementation of hatchery reform. The intent of hatchery reform is to improve hatchery effectiveness, ensure compatibility between hatchery production and salmon recovery plans and rebuilding programs, and support sustainable fisheries. WDFW Policy C-3619 works to promote the conservation and recovery of wild salmon and steelhead and provide fishery-related benefits by establishing clear goals for each state hatchery, conducting scientifically defensible-operations, and using informed decision making to improve management. It is recognized that many state operated hatcheries are subject to provisions under *U.S. v Washington* (1974) and *U.S.*

v Oregon and that hatchery reform actions must be done in close coordination with tribal co-managers. Washington Fish and Wildlife Commission Policy: POL-C3619.

Guidelines from the policy include:

1. Use the principles, standards, and recommendations of the Hatchery Scientific Review Group (HSRG) to guide the management of hatcheries operated by the Department.
2. Develop watershed-specific action plans that systematically implement hatchery reform as part of a comprehensive, integrated (All-H) strategy for meeting conservation and harvest goals at the watershed and Evolutionarily Significant Unit (ESU)/Distinct Population Segment (DPS) levels. Action Plans will include development of stock (watershed) specific population designations and application of HSRG broodstock management standards.

Statewide Steelhead Management Plan. In February 2008, WDFW formally adopted a *Statewide Steelhead Management Plan* (SSMP) that guides statewide policies, strategies and actions pertaining to steelhead in Washington State. This plan calls for the development of regional watershed plans that further guide steelhead management at the local level. WDFW is currently developing regional watershed plans for all LCR steelhead populations. This process includes the development of stakeholder workgroups that provide input into the planning process. During this process, all current hatchery steelhead programs are being reviewed and evaluated for possible program improvements. Program improvements could include, but are not limited to, changes in smolt release numbers, changes in broodstock composition (e.g. converting to indigenous stock), and changes in fishery regulations to better protect adults and/or juveniles. Additionally, the SSMP calls for the development of a network of wild steelhead gene banks throughout the state and these gene banks will be implemented through the regional watershed steelhead management plan development process.

> "The Department will use the SSMP to build on the habitat work already done by the watershed and regional groups by incorporating hatchery, harvest and hydro actions into watershed plans. These watershed plans will then be combined into Regional Management Plans for each Distinct Population Segment (DPS)."

- In Southwest Washington (Region 5), WDFW will develop watershed work groups to assist in the development of the regional watershed plans. Work group status is:
  - Coweeman, Toutle, Kalama – completed in 2012/2013
  - Upper & Lower Gorge – completed in 2013
  - Lewis, Salmon, Washougal – completed in 2014
  - Grays, Elochoman/Skamokawa, Mill/Abernathy/Germany – proposed to start in 2014/2015
  - Upper & Lower Cowlitz – plans will be developed consistent with the updated Fisheries and Hatchery Management Plan (FHMP), developed by the Cowlitz Fisheries Technical Committee (FTC) with input from the Cowlitz Ad-Hoc Advisory Group.

Several strategies and actions included in the SSMP are shown below:

- *Establish Network of Wild Stock Gene Banks*. The gene bank must be a place where wild stocks are largely protected from the effects of hatchery programs. At least one wild stock gene bank will be established for each major population group in each steelhead DPS.
- *Describe Path with Measurable Benchmarks to Long-term Goals*. Evaluate the current benefits and risks of the current program relative to the long-term goals for each stock. Describe a path to the long-term goals with measurable benchmarks for modifications to fishery, hatchery, and habitat management and the expected performance of each stock. For programs affecting the wild stocks of importance for conservation and recovery, the long-term goal will include the following elements:

- Segregated programs implemented to enhance harvest opportunities (i.e. segregated harvest program) will result in an average gene flow of less than 2% from the hatchery to the wild stock. Use broodstock that originated from releases of juveniles in that watershed unless no hatchery or trapping facility exists.
- Segregated conservation programs implemented to maintain the hatchery population as a distinct or genetically segregated population in order to preserve and recover depleted wild stocks.
- Assess the current risks and benefits, including economic benefits, of each artificial production program relative to genetic, demographic, and ecological risk factors. Key factors to include in the risk assessment for each type or program are discussed below.
    - Segregated Programs. Key risks associated with segregated programs are a potential loss of diversity (within and between stocks), loss of fitness, and competition.
        - Evaluate the potential range of gene flow from returning adults of hatchery-origin to wild-origin stocks in all watersheds where Chambers Winter or Skamania Summer steelhead stocks are released, or where a segregated program has been in place for three or more generations.
    - Where risks are inconsistent with watershed goals, implement one or more of the following actions:
        - Leave trapping facilities open during the entire return time for adults of the segregated stock.
        - Eliminate recycling of hatchery-origin adults to anadromous waters.
        - Release steelhead juveniles from steelhead programs only at locations where returning adults can be captured.
        - Increase the harvest rates on hatchery-origin fish.
        - Reduce the number of fish released or change the release location, rearing practices affecting the rate of residualism, or other program characteristics to reduce the rate of gene flow.
        - Eliminate the segregated hatchery program.
        - Replace the segregated program with an integrated program with risks that are consistent with watershed goals.

Conservation and Sustainable Fisheries Plan (CSFP): The CSFP is a draft plan that has been developed to meet WDFW's responsibilities outlined in the Lower Columbia Salmon Recovery Plan (LCSRP) and address the HSRG suggested solutions and achieve HRSG standards for primary, contributing and stabilizing populations. The plan describes the implementation of changes to hatchery and harvest programs and how they assist in recovery and achieve HSRG guidelines. The draft plan also identifies Viable Salmonid Population (VSP) parameters that will be addressed.

Hatchery Action Implementation Plans (HAIP): The HAIPs illustrate how WDFW is implementing hatchery programs to incorporate the HSRG guidelines. The plans provide the current programs and explain the future goals.

Lower Columbia Salmon Recovery Plan (LCSRP): Some sub-basins will be free of hatchery influence and hatchery programs. In other sub-basins, hatchery programs will serve specific conservation and harvest purposes consistent with goals for naturally-spawning populations. The mosaic of programs is designed to ensure that overall each DPS will be naturally self-sustaining.

Strategies

1. Reconfigure production-based hatchery programs to minimize impacts on natural populations and complement recovery objectives.
2. Adaptively manage hatcheries to respond to future knowledge, enhance natural production, and improve operational efficiencies.

3.2 List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

Future Brood Document. Hatchery salmon and steelhead production levels are detailed in the annual Future Brood Document, a pre-season planning document for fish hatchery production in Washington State for the upcoming brood stock collection and fish rearing season (July 1 – June 30).

Cowlitz Basin Fish Management Plan. The Department of Fish and Wildlife has developed a framework for a fish management plan for the Cowlitz River Basin. This plan is intended to provide management direction for fish protection and restoration in a manner that is consistent with the Endangered Species Act (ESA) and the Wild Salmonid Policy (WSP). The Wild Salmonid Policy was developed by WDFW in response to a mandate from the Washington State Legislature (ESHB 1309) in 1993.

Cowlitz Hatchery Mitigation Agreement (*FERC Project #2016*). After the original license expired on December 31, 2001, the Project has operated under annual licenses until the new thirty-five year license was issued March 13, 2003 (effective on July 18, 2003). The new license requires formation of the Cowlitz Fisheries Technical Committee (FTC), which includes NMFS, USFWS, WDFW, WDOE, American Rivers/Trout Unlimited, the Yakama Nation, and Tacoma Power. The FERC license was amended July 2004, based on NOAA's Biological Opinion that required Tacoma Power to achieve a fish passage survival goal of 75-95% (with best available technology). Tacoma Power has published an annual progress report since 2005.

Cowlitz Fisheries and Hatchery Management Plan (*FHMP update 2011*). The FHMP is part of the new Settlement Agreement (Article 6), that identifies the quantity and size of fish produced at the hatcheries, the rearing and release strategies for each stock, plans for funding on-going monitoring and evaluation, and management strategies consistent with the objective of maximizing natural-origin fish production. The plan requires updates every six-years.

Cowlitz Falls Project- Lewis County Public Utility District (*LCPUD*) (*FERC No. 2833*). The Lewis County PUD No. 1 constructed a hydroelectric project on the Cowlitz River, which was completed in 1994. BPA constructed and oversees the operation of a downstream fish collection facility at the dam. NOAA issued a Biological Opinion dated June 2, 2009.

See also HGMP section 3.1.

3.3 Relationship to harvest objectives.

3.3.1 Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available. *Hatchery Escapement (FHMP)*

It is estimated that approximately 369 adults are needed to produce 644,000 juvenile winter-late steelhead smolts. The 1,000 adult escapement goal for natural production would be considered a minimum value.

WDFW has implemented restrictive regulations permitting the retention of marked adult hatchery steelhead only and requiring the release of naturally produced adult steelhead (WDFW 2003a). All hatchery steelhead released in the action area are externally marked with an adipose fin-clip to allow for these selective fisheries. WDFW (2003a) will manage the tributary harvest of summer and winter steelhead stocks in the action area not to exceed a maximum harvest rate of 10% of the natural spawning population, although the actual impacts are expected to be closer to 5% (WDFW 2003a). The program will continue to provide fish for harvest while minimizing adverse effects on ESA-listed fish. Specific harvest rates for hatchery steelhead are unknown,

however punch card estimates for total harvest of marked hatchery steelhead are available by month for all areas open to sport harvest.

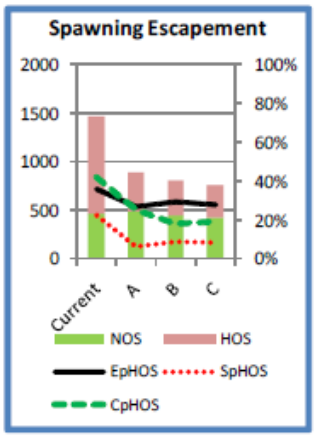
WDFW protects listed fish and provides harvest opportunity on the steelhead programs through the Lower Columbia Region Fish Management and Evaluation Plan (FMEP) submitted to NOAA on December 31, 2003. The primary focus of anadromous salmonid fisheries in the LCR is to target harvest of known hatchery origin steelhead, spring Chinook, coho salmon, sea-run cutthroat, and fall Chinook. The primary focus for resident game and non-game fish in the LCR tributaries is to 1) provide recreational opportunities, 2) minimize impacts to juvenile anadromous fish through time and area closures, and 3) minimize impacts to listed species.

The lower Cowlitz River steelhead fisheries would be managed to achieve this minimum escapement target. Commercial fisheries in the mainstem Columbia River may occur in February and March with incidental harvest of both natural and hatchery winter steelhead with an adipose fin clipped. Sport fisheries selective for Cowlitz River winter-late steelhead stock that are adipose fin clipped occur in the mainstem Columbia and the lower Cowlitz River from January through May. Through the FMEP for the lower Columbia River, has estimated that naturally spawned winter-late steelhead will have an estimated mortality of approximately 4% in winter steelhead fisheries and approximately 3% mortality in sport fisheries directed at resident trout.

The releases of adipose fin-clipped winter-late steelhead provide sport harvest opportunity for anglers in the Cowlitz and lower Columbia Rivers. Selective harvest regulations allow only the harvest of adipose or ventral fin clipped steelhead in the lower Columbia River. Below the Barrier Dam, at the Cowlitz Salmon Hatchery, anglers may harvest only adipose-fin clipped steelhead. Adults with an adipose and right or left ventral fin clip that return to CSH are transported and released in the upper Cowlitz watershed and Tilton River to provide a harvest opportunity for anglers and provide additional spawners for the restoration program. Specific harvest rates for each group of hatchery steelhead are unknown, (because both groups are adipose fin clipped), however, punch card estimates for total harvest of marked hatchery steelhead are available by month for all areas open to sport harvest.

Lower Cowlitz Steelhead

	Recent Past	A Contributing Population Biological Targets	Future Options: no weir A	Weirs B	Weirs C
Natural Production					
Productivity (Smolts/Spawner)	12		16	15	15
Capacity (Smolts)	3660		4925	4687	4760
SAR	11.8%		11.8%	11.8%	11.8%
Fitness	0.5		0.67	0.64	0.65
PNI	-	> 0.5	0.53	0.51	0.52
Total Effective pHOS (EpHOS)	36%	< 30%	27%	29%	28%
Seg Effective pHOS (SpHOS)	22%	< 10%	6%	9%	8%
Seg Census pHOS (CpHOS)	42%	< 30%	25%	18%	19%
NOR Abundance potential	468	> 400	486	450	433
Hatchery Production					
Late Winter Sthd					
Release LC program	284,681		400,000	481,389	525,000
Release UC program	-		-	118,000	118,000
Stray Rate	10%		10%	10%	10%
Rel. Reprod. Success	80%		80%	80%	80%
Weir Efficiency	0%		0%	20%	35%
Harvest Rate	62%	60%	62%	62%	62%
SAR	1%		1%	1%	1%
Summer Sthd					
Release	550,000		200,000	650,000	650,000
Stray Rate	10%		10%	10%	10%
Rel. Reprod. Success	18%		18%	18%	18%
Weir Efficiency	0%		0%	80%	80%
Harvest Rate	70%	70%	70%	70%	70%
SAR	4%		4%	4%	4%
Early Winter Sthd					
Release	300,000		0	0	-
Stray Rate	10%		10%	10%	10%
Rel. Reprod. Success	20%		20%	20%	20%
Weir Efficiency	0%		0%	20%	20%
Harvest Rate	55%	55%	55%	55%	55%
SAR	2%		2%	2%	2%
Expected Catch	20,467		8,083	21,921	22,192



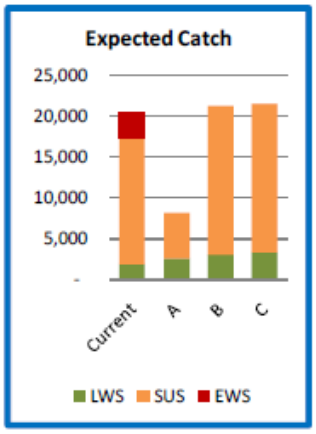
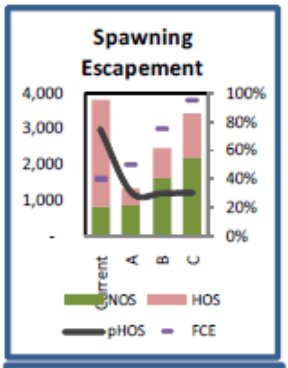


Figure 3.3.1.1: Biological targets, key assumptions and expected outcomes under recent conditions and under future options to meet long-term harvest and conservation goals for Lower Cowlitz steelhead (Source: FHMP update 2011).

Upper Cowlitz Steelhead — **A Primary Population**

Natural Production	Recent Past (2009)	Biological Targets	Options to meet Long-term Goals A	B	C
Productivity (Smolts/Spawner)	19		34	34	34
Capacity (Smolts)	12,791		22,880	23,097	23,091
SAR	4.72%		5.90%	8.85%	11.21%
FPS	40%		50%	75%	95%
Fitness	0.5		0.89	0.90	0.90
PNI	0.57	> 0.67	0.77	0.77	0.77
Effective pHOS	74%	< 30%	30%	30%	30%
Terminal Harvest Rate	3%		3%	3%	3%
NOR Abundance potential	818	> 1,000	861	1,617	2,216
Hatchery Production					
Release (from Hatchery)	99,340		118,053	118,053	118,053
pNOB	100%		100%	100%	100%
Adults Transported above CF	3,500		550	1,000	1,400
Harvest Rate in Upper Cowlitz	15%		15%	15%	15%
Expected Catch in Upper Cowlitz	525		83	150	210



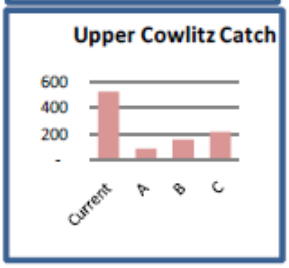
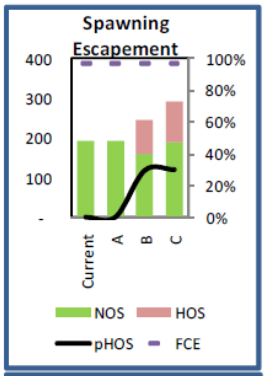


Figure 3.3.1.2: Biological targets, key assumptions and expected outcomes under recent conditions and under future options to meet long-term harvest goals for Upper Cowlitz steelhead (Source: FHMP update 2011).

Tilton Steelhead — **A Contributing Population**

Natural Production	Recent Past (2009)	Biological Targets	Options to meet Long-term Goals A	B	C
Productivity (Smolts/Spawner)	10		19	12	17
Capacity (Smolts)	1,661		3,322	2,080	2,959
SAR	11.45%		11.45%	11.45%	11.45%
FPS	97%		97%	97%	97%
Fitness	0.5		1.00	0.63	0.89
PNI	1.00	> 0.5	1.00	0.50	0.77
Effective pHOS	0%	< 30%	0%	30%	30%
Seg pHOS	0%	> 10%	0%	30%	30%
Terminal Harvest Rate	4%		4%	4%	4%
NOR Abundance potential	194	> 200	194	160	190
Hatchery Production					
Release (from Hatchery)	-		-	39,816	51,561
pNOB	0%		0%	30%	100%
Adults Transported above Mayfield			0	140	170
Harvest Rate	40%		40%	40%	40%
Expected Catch	8		8	62	76



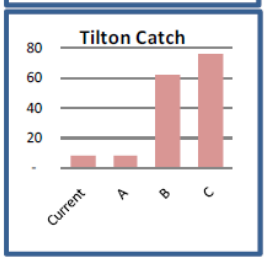


Figure 3.3.1.3: Biological targets, key assumptions and expected outcomes under recent conditions and under future options to meet long-term harvest goals for Tilton steelhead (Source: FHMP update 2011).

Table 3.3.1.4: Sport harvest and escapement, Cowlitz River total winter steelhead, based on WDFW Catch Record Card (CRC) data for brood years 2001-2008, release years 2001-2010, fishery years 2003-2012.

Return Year	Total Released	Sport Harvest	Hatchery Escapement	SAR %
2004	446,009	1,397	2,163	0.80%
2005	367,102	786	1,478	0.62%
2006	253,093	1,777	1,839	1.43%
2007	290,634	2,086	1,525	1.24%
2008	352,411	2,051	1,803	1.09%
2009	351,435	3,663	5,578	2.63%
2010	425,502	7,689	8,187	3.73%
2011	427,222	6,107	5,806	2.79%
2012	408,458	6,267	7,636	3.40%
Average	**369,096**	**3,536**	**4,002**	**1.97%**

Source: WDFW Catch Record Card (CRC) data, WDFW Hatcheries Headquarters Database 2014.
Notes: Freshwater Sport based on CRC data for 2004-2012
Harvest based on Cowlitz and Tilton Rivers catch from February to May only, does not include mainstem Columbia harvest.

3.4 Relationship to habitat protection and recovery strategies.

The re-licensing impact associated with Tacoma Power and Lewis County PUD continued operation of hydroelectric facilities including the dams creating Mayfield Lake, Riffe Lake and Lake Scanewa are major factors that affected natural production of resident and anadromous fish species. Project impacts are to fish and wildlife but the following pertains to fish only and include:

1) impacts to resident and anadromous fishes in the reservoirs, downstream, and upstream caused by project-related barriers, false attraction, entrainment in intakes, and other impediments to fish migration;
2) impacts to resident and anadromous fishes in the reservoirs, downstream, and upstream caused by project-related mitigation hatchery fish interactions with remaining wild fish;
3) impacts to resident and anadromous fishes in reservoirs from fluctuations in reservoir level;
4) impacts to resident and anadromous fishes downstream of the dams caused by project-related flow-dependent habitat changes;
5) impacts to resident and anadromous fishes downstream of the dams caused by project-related flow fluctuations;
6) impacts to resident and anadromous fishes in the reservoir and downstream caused by project-related channel changes stemming from alteration of natural sediment transport;
7) changes in dynamics of fish-predator interactions resulting from change in fish escape options;
8) changes in water quality (e.g., temperature, dissolved gases, suspended sediment, pollutants) which can impact fish (and wildlife);
9) interruption of the transport of large wood and nutrients from upstream to downstream reaches and nutrient transport upstream in the form of adult anadromous fish;
10) inundation of anadromous fish spawning, incubation, and rearing habitat by Mayfield, Mossyrock and Cowlitz Falls dams, resulting in loss of anadromous fish production from the inundated reaches.

Several FERC Settlement Agreement articles address passage problems in the system including: 1) Downstream Fish Passage for Riffe Lake and Cowlitz Falls; 2) Downstream passage for Mayfield Lake; and 3) Upstream Fish Passage for the Barrier Dam, Mossyrock and Mayfield. The articles also deal with future proposals and improvement needed for restoring processes upstream and down. A

fish habitat fund of up to $3 million for identified projects in the lower Cowlitz River has been created (Article 11). In addition, a fish habitat fund of $15 million for identified projects in the upper Cowlitz River basin has been created (Article 3) in case further efforts towards volitional upstream passage are suspended for the current license period.

Additional Processes:
The following processes have included habitat identification problems, priority fixes and evolved as key components to the *Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans* (Volume 1; Clark, Cowlitz, Lewis, Skamania and Wahkiakum Counties, LCFRB 2010) and Lower Columbia River Salmon and Steelhead ESA Recovery Plan (Dornbusch and Sihler 2013).

Sub-Basin Planning. Regional sub-basin planning processes include the Cowlitz River Sub-basin Salmon and Steelhead Production Plan, September 1, 1990 with a more recent Draft Cowlitz River Sub-basin Summary (May 17, 2002) was prepared for the Northwest Power Planning Council. The Sub-basin efforts provided initial building blocks for the LCFRB regional recovery plan.

The Lower Columbia fish Recovery Board (LCFRB) has adopted The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans (Volume 1; Clark, Cowlitz, Lewis, Skamania and Wahkiakum Counties, December 15, 2004, revised June 6, 2010) with the understanding that Implementation of the schedule and actions for local jurisdictions depends upon funding and other resources.

Habitat Treatment and Protection Ecosystem Diagnosis and Treatment (EDT) compares habitat today to that of the basin in a historically unmodified state. EDT has been modeled for productivity in the Cowlitz basin in The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans and has been used by Tacoma Power for the FERC re-licensing agreements for the upper basin productivity goals. WDFW is also conducting a Salmon Steelhead Habitat Inventory Assessment Program (SSHIAP), which documents barriers to fish passage. WDFW's habitat program issues hydraulic permits for construction or modifications to streams and wetlands. This provides habitat protection to riparian areas and actual watercourses within the watershed.

Limiting Factors Analysis (LFA). A WRIA 26 LFA was conducted by the Washington State Conservation Commission (May 2002). WRIA 26 was separated into seven sub-basins; Coweeman, Lower Cowlitz, Toutle, Mayfield/Tilton, Riffe Lake, Cispus, and Upper Cowlitz.

3.5 Ecological interactions

(1) *Salmonid and non-salmonid fishes or species that could negatively impact the program:* Out-migrant hatchery fish can be preyed upon through the entire migration corridor from the river sub-basin to the mainstem Columbia River and estuary. Northern pikeminnows and introduced spiny rays, as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons in the Columbia mainstem sloughs, can prey on steelhead smolts. Mammals that can take a heavy toll on migrating smolts and returning adults include: harbor seals, sea lions, river otters and orcas

(2) *Salmonid and non-salmonid fishes or species that could be negatively impacted by the program:* Co-occurring natural salmon and steelhead populations in local tributary areas and the Columbia River mainstem corridor areas could be negatively impacted by program fish. Of primary concern are the ESA listed endangered and threatened salmonids: Snake River fall-run Chinook salmon ESU (threatened); Snake River spring/summer-run Chinook salmon ESU (threatened); Lower Columbia River Chinook salmon ESU (threatened); Upper Columbia River spring-run Chinook salmon ESU (endangered); Columbia River chum salmon ESU (threatened); Snake River sockeye salmon ESU (endangered); Upper Columbia River steelhead ESU (endangered); Snake River Basin steelhead ESU (threatened); Lower Columbia River steelhead ESU (threatened); Middle Columbia River steelhead ESU (threatened); and the Columbia River distinct population segment of bull trout (threatened). Listed fish can be impacted through a complex web of short and long term processes and over

multiple time periods which makes evaluation of this a net effect difficult. Recent WDFW research (Sharpe et al. 2008, Pflug et al. 2013) has shown that the predation risk from hatchery steelhead smolt releases on native steelhead smolts and other natural-origin fry and smolts are minimal. **See also HGMP section 2.2.3** "*Predation and Competition*."

(3) *Salmonid and non-salmonid fishes or other species that could positively impact the program.* Only hatchery steelhead are released, but natural production of steelhead, Chinook, coho and chum salmon occurs in this system along with non-salmonid fishes (sculpins, lampreys and sucker etc.). The presence of other natural-origin salmonids in the food web potentially reduces the impacts associated with predation described in "(1) *Salmonid and non-salmonid fishes or species that could negatively impact the program"* above.

(4) *Salmonid and non-salmonid fishes or species that could be positively impacted by the program.* Nutrients provided by decaying carcasses might benefit fish and aquatic invertebrates in freshwater (Wipfli et al. 1998; Mathisen et al. 1988; Bilby et al. 1996). The program could also positively impact freshwater and marine species that prey on juvenile fish. These species include:

- Northern pikeminnow
- Chinook salmon, steelhead, coastal cutthroat trout
- Pacific staghorn sculpin
- Eulachon
- Numerous marine pelagic fish species
- Avian predators, including: gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons
- Mammals including: harbor seals, sea lions, river otters and orcas.

4 SECTION 4. WATER SOURCE

4.1 Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Table 4.1.1: Water sources at Cowlitz Trout and Cowlitz Salmon Hatcheries.

Facility	Water Source	Water Right		Available Water Flow	Avg Water Temp (°C)	Usage	Limitations
		Record/Cert. No.	Permit No.				
Cowlitz Trout Hatchery	Wells (9)	G2-*08490C WRIS (north)/ 06331	07887	4,861 gpm	8-12°	Initial rearing. Also used to regulate water temperature in the facility.	Water from the north well has some bacteria and gas problems, not currently used.
		G2-*08491C WRIS (south)/ 06364	07888	860 gpm			
	Ozone Plant (Cowlitz River surface water)	S2-*19839C/ 10453	14603	20 cfs	n/a	Used from May to late-November/ early-December to avoid river pathogens (primarily *Ceratomyxa shasta*).	Cannot supply the volume of water needed from early-December to mid-May
	Cowlitz River (surface)			56 cfs	4-15	Primary supply and backup water source in case of well water system failure.	Not treated with ozone.
Cowlitz Salmon	Well	G2-*08829CWRIS/ 06699	08197	2,060 gpm	6-9	Incubation/early rearing	
	Well	G2-*8830CWRIS/ 06700	08198	2,860 gpm			
	Cowlitz River (surface)	S2-*19889CWRIS/ 10450	14724	200 cfs	4-13	Hatchery supply	BKD, IHNV, *C. shasta*

Source: Phinney 2006, WDOE Water Resources Explorer 2014, WDFW Hatchery Headquarters Database.

Cowlitz Trout Hatchery: The facility has three water sources. A portion of the water is supplied from nine shallow wells on both sides of the river, at up to 5 cubic feet per second (cfs), with a water temperature range from 8° to 12°C (Harza 1997a in FERC 2001). The wells are used for initial rearing. Water from the north well has some bacteria and gas problems; Tacoma Power has installed power to the south wells until a system upgrade is completed. The north well has not been utilized since fall 2000.

An ozone plant is used to disinfect up to 20 cfs of water from the Cowlitz River. The ozonated water is used from May to late-November/early-December to avoid river pathogens (primarily *Ceratomyxa shasta*); the plant cannot supply the volume of water needed from early-December to mid-May. The plant is capable of producing 200 pounds of ozone daily, and is equipped with an auxiliary electrical generator. It is the first of its kind designed specifically for hatchery use. The river intake is able to supply 50 cfs of river water, or 20 cfs while the ozone plant is operating. Water temperature ranges from 4° to 16°C, and only rarely exceeds 15°C.

Water discharged from the CTH into Blue Creek (WRIA 26.0527, tributary to the Cowlitz is RKm 66.5) and Cowlitz River and is a little warmer than the Cowlitz River during spring and summer. The dissolved oxygen levels of the effluent are typically 1-2 mg/L lower than the Cowlitz River (Harza 2000 in FERC 2001). Re used well water from incubation units, if in use, is redirected to rearing units.

The water right permit for the Cowlitz Trout Hatchery formalized through the Washington Department of Ecology (**Table 4.1.1**), and was obtained by Tacoma Power in 1966 (surface) and 1967 (wells).

Cowlitz Salmon Hatchery: The Cowlitz Salmon Hatchery is supplied from three sources. The majority of water is supplied from the Cowlitz River, with a maximum of 75,000 gallons per minute (gpm) available to the rearing ponds. An additional 15,000 gpm is available for the fish separator and ladder. The other two sources are "C-wells" (1,000 gpm) and "PW–wells"(700 gpm). The wells are used between August and July, normally for egg incubation and early fry rearing. The temperature of water supplied to the Cowlitz Salmon Hatchery ranged from 4° to 13°C for river water, and from about 6° to 9°C for the groundwater (Harza 1997a in FERC 2001). An additional water right of 8 cfs was obtained for the BPA funded Stress Relief Ponds (SRP) for utilization with the upper Cowlitz River Restoration Project. Stress relief ponds have an alarm at the head box.

The water right permits for the Cowlitz Salmon Hatchery formalized through the Washington Department of Ecology (see **Table 4.1.1**), and was obtained by Tacoma Power in 1966 (surface) and 1967 (wells).

These facilities operate under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) general permit which conducts effluent monitoring and reporting and operates within the limitations established in its permit administered by the Washington Department of Ecology (DOE).

Discharges from the cleaning treatment system are monitored as follows:

- *Total Suspended Solids (TSS)* Once per month and one time on rearing lake drawdown on composite effluent, maximum effluent and influent samples.
- *Settleable Solids (SS)* Once per week on effluent and influent samples.
- *In-hatchery Water Temperature* - daily maximum and minimum readings.

Table 4.1.2: Record of NPDES permit compliance at Cowlitz Salmon and Cowlitz Trout Hatcheries.

Facility/ Permit #	Reports Submitted Y/N			Last Inspection Date	Violations Last 5 yrs	Corrective Actions Y/N	Meets Compliance Y/N
	Monthly	Qtrly	Annual				
Cowlitz Salmon Hatchery WAG13-1021	Y	Y	Y	3/6/2013	0	N	Y
Cowlitz Trout Hatchery WAG13-1034	Y	Y	Y	3/20/2013	0	N	Y

Source: Ann West, WDFW Hatcheries Headquarters Database 2014.

4.2 Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

The surface water intake at this facility is in compliance with state and federal guidelines (NMFS 1995, 1996), but does not meet current *Anadromous Salmonid Passage Facility Design* criteria (NMFS 2011a). The approach velocity and screen types are compliant, but concern remains with natural-origin fry in the vicinity of the trout hatchery, due in part to the greater numbers of fry that could exist downstream of the Barrier Dam. No major modifications of the intakes at Cowlitz Salmon or Cowlitz Trout Hatcheries were proposed by Tacoma Power for the renovations in 2008. Some type of electrical barrier in the structure might also be considered to improve the existing situation (Tacoma Power comments on the *Draft Hatchery Complex Remodel and Phase-in Plan*).

5 SECTION 5. FACILITIES

5.1 Broodstock collection facilities (or methods).

Cowlitz Salmon Hatchery (*CSH*): The adult collection facility at the Cowlitz Salmon Hatchery consists of a 318-ft long Barrier Dam across the Cowlitz River. The Barrier Dam directs upstream-migrant fish to the fish ladder, which leads to the sorting and transfer facilities. Right and left bank entrances to the fish ladder and an under-spillway transport channel connects the two ladder entrances to the sorting, transfer and holding facilities. Since construction in 1968, neither the transport channel nor the left bank entrance is in use because of design problems with the attraction flow. There is also an electrical field at Barrier Dam to aid in blocking fish. Adults can be sorted to holding ponds or also held in one of six circular tanks if they are to be transported. The adults can also be transferred to a number of other ponds including nine concrete ponds (80' x 15' x 6') via transfer tubes.

Cowlitz Trout Hatchery (*CTH*): The facility has an adult trapping and holding facility that includes a weir and fish ladder in Blue Creek but has not been used since 2007 for trapping. Adult hold facility consists of three adult ponds @ 10'x150'x5'. Fish are hand sorted and handled according to the *Cowlitz Complex Adult Fish Handling Protocol*. Fish are returned from this facility to the river by truck.

5.2 Fish transportation equipment (description of pen, tank truck, or container used).

Table 5.2.1: Transportation equipment available at Cowlitz Hatchery Complex.

Equipment Type	Capacity (gallons)	Supp. Oxygen (y/n)	Temp. Control (y/n)	Average Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
Tanker Truck	1,500	Y	N	See below	Sodium chloride (Salt)	5,000 ppm (~0.5%)
Tanker Truck	750	Y	N	See below	Sodium chloride (Salt)	5,000 ppm (~0.5%)
Tanker Truck	100	Y	N	See below	Sodium chloride (Salt)	5,000 ppm (~0.5%)
Tanker Truck	250	Y	N	See below	Sodium chloride (Salt)	5,000 ppm (~0.5%)

CSH: The facility has three 1,500 gallon tanker trucks capable of hooking to the underside of the circular tanks and receiving fish through water displacement. This process results in low stress to the adult fish. All vehicles have juvenile and adult holding capability. The trucks are equipped with flumes for planting fish wherever there is adequate access for these trucks along the river or to the Cowlitz Trout Hatchery adult holding ponds. In addition, several smaller tankers with air stones (one 750-gallon, one 1,000-gallon fiberglass tank, and several 250-gallon tanks) are utilized for moving fish around and between the facilities. All vehicles have juvenile and adult holding capability, and are equipped with oxygen and recirculating systems.

CTH: The facility has one 1,500 gallon fish tanker which can be used to transfer juvenile fish between facilities. The vehicle has juvenile and adult holding capability, and is equipped with oxygen and recirculating systems. The tanker also has a hydraulic loading boom for loading adults from the CTH adult ponds and outfalls.

5.3 Broodstock holding and spawning facilities.

Table 5.3.1: Adult holding/spawning facilities available at Cowlitz Salmon Hatchery.

Ponds (number)	Pond Type	Volume (cu. ft.)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
6	Circular Separator Tanks	643	13.5	-	-	800
9	Concrete Ponds	7,200	80	15	6.0	2,700

CSH. Adults are separated to the following ponds for holding or transfer. The circular tanks are designed to hold up to 1,250 pounds of fish.

Table 5.3.2: Adult holding/spawning facilities available at Cowlitz Trout Hatchery.

Ponds (No.)	Pond Type	Volume (cu. ft.)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
3	Adult holding ponds	7,500	150	10	5	2,000

CTH. The facility has three 10' X 150' X 5' adult holding ponds. Adult trapping at CTH was discontinued in 2007 and are no longer used with the exception of the kelt reconditioning program. Wild late winter steelhead adults returning downstream collected at the Cowlitz Falls Fish Collection Facility are trucked to the CTH.

5.4 Incubation facilities.

Table 5.4.1: Incubation vessels available at Cowlitz Salmon Hatchery.

Type	Units (number)	Flow (gpm)	Volume (cu. ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Vertical stack units (16 trays/ Stack Unit)	160 (2,560 trays)	12 gpm on 4 units-		7,000	7,000
Free style deep isolation incubators	8 units	24 gpm all units		250,000 - 300,000[a]	

Vertical stack units (16 trays/Stack Unit) Recirculation Systems A&B	36 Stacks (288 trays)	3-5	-	10,000[b]	10,000[b]

[a] Green egg stage only.
[b] Steelhead and cutthroat.

CSH. The facility incubates steelhead on Recirculation Systems A&B on ground water via once thru mode (fresh supply) or on recirculation mode (reclaimed supply with added fresh or makeup supply).

Table 5.4.2: Incubation vessels available at Cowlitz Trout Hatchery.

Type	Units (number)	Flow (gpm)	Volume (cu. ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Shallow troughs (2-tier) with incubation baskets	88	3.5-5.0	7.165/ trough	20,000 (5 baskets/trough)	21,000 (1 basket/trough)

CTH. The has 88 shallow troughs for incubation and early rearing. Incubation and early rearing of all stocks now takes place at CSH.

5.5 Rearing facilities.

Table 5.5.1: Rearing ponds available at Cowlitz Trout Hatchery.

Ponds (No.)	Pond Type	Volume (cu. ft.)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Max. Flow Index	Max. Density Index
88	Shallow troughs	7.165	14.33	1.0	0.5	5.0	1.0	0.25
2	Intermediate troughs	40.4	13.5	2.3	1.3	30	1.0	0.25
2	Magnum troughs	145.2	11	4.4	3	60	1.0	0.25
6	Fry raceways	4,500	90	20	2.5	300	1.0	0.25
24	Concrete raceways	5,340	90	20	2.5	1,000	1.0	0.25
3	5.0 acre lake	1,856,000	1,450	160	8.0	4,000	1.0	0.25
1	2.5-acre Lake	1,113,600	870	160	8.0	4,000	1.0	0.25
3	Adult holding ponds	7,500	150	10	5.0	2,000	4 lbs/gpm	

CTH. The facility has 88 shallow trough incubators, six fry raceways each 10' x 90' x 2.5' , 24 raceways each 20' x 90' x 2.5' , three 5-acre lakes, one 2.5 acre lake and three adult holding ponds each 10' x 150' x 5'. The late winter steelhead programs are reared in raceways and earthen lakes. Earthen lake 4, 2.5-acre is the preferred vessel for final rearing because it is fully netted from predators and has more feeders per acre.

Table 5.5.2: Rearing ponds available at Cowlitz Salmon Hatchery.

Ponds (No.)	Pond Type	Volume (cu. ft.)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Max. Flow Index	Max. Density Index
9	Rearing Troughs Recirculation Systems A&B	477	56.5	3.75	2.25	45-155	1.0	0.25
3	Rearing Troughs Recirculation Systems A&B	152	18	3.75	2.25	45-155	1.0	0.25

CSH. The facility early rears steelhead in troughs on Recirculation Systems A&B on ground water via once thru mode (fresh supply) or on recirculation mode (reclaimed supply with added fresh or makeup supply).

5.6 Acclimation/release facilities.

CTH. Raceways at the trout hatchery have no outlet to the river, so program fish must be trucked out of these vessels for release. Water discharged from the raceways can be routed to the adult ponds, the rearing lakes or the pollution abatement ponds, but not directly to the river. The rearing lakes are used for final rearing of yearlings to smolts and directly discharge to the Cowlitz River via Blue Creek.

CSH. Smolts collected at the Cowlitz Falls Fish Facility are trucked below the dams and released at RKm 79 from twelve stress-relief raceways located at the CSH. These raceways were constructed as part of the reintroduction and restoration effort, and were designed to allow a time period for recovery (up to 48 hours), and volitional release. Smolts collected at the facility include naturally-produced smolts from natural-origin and hatchery-origin adults that spawned in the upper watershed.

5.7 Describe operational difficulties or disasters that led to significant fish mortality.

CTH. Generally, no physical operational difficulties have been experienced. Pathogen outbreaks of *Ceratomyxa shasta* and IHNV at Cowlitz Trout Hatchery have chronically caused some significant fish mortality in the past. Installation of an ozone treatment facility at the Cowlitz Trout Hatchery in 1991 has decreased mortality significantly. Other pathogens that have to be managed are bacterial cold water disease and the external parasite *Trichodina*.

Avian predation on the rearing lakes has been major cause of the numerous shortages on all stocks since 2003. USDA has been contracted to nonlethal haze avian predators from October thru April each year.

CSH. Recirculation Systems A&B with the incubation and early rearing of steelhead stocks have experienced epizootic outbreaks of the bacterial infections; Bacterial Cold Water Disease (BCWD) and Bacterial Gill Disease (BGD). The recirculation process has been the concern but infections have occurred of both ground water via once thru mode and more so on recirculation mode.

5.8 Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

Cowlitz Hatchery Complex staff are available 24/7 ready to react to system failure and staff have emergency procedures and plans in place. All systems are alarmed to alert staff of failure.

CTH. Safeguards to insure an uninterrupted water supply at the Cowlitz Trout Hatchery include auxiliary power to supply two of the four river water intake pumps, the north well (not currently in use), and the ozone plant. All water sources and head boxes of all raceways are equipped with low water alarms. The water intake structure also has an alarm for the river water, south well water and the north well water. All wells and river pumps are also alarmed. During the year 2000 (December), auxiliary power backup was provided to the south wells.

The river water is a source of numerous pathogens. This water is disinfected by the ozone plant during the warmer rearing months. The water is re-used between numerous ponds, so there is the possibility for the spread of infection. Flooding and muddy water occasionally occurs even though the river level is controlled by three dams.

CSH. Safeguards to insure an uninterrupted water supply at the Cowlitz Salmon Hatchery, Recirculation Systems A&B with the incubation and early rearing of fish stocks; auxiliary power from emergency generators, backup well supply from the denitrofication tower, recirculation system will operate as a closed system as long water quality issues don't arise (dissolved oxygen, ammonia levels, temperature levels, and water supply).

IHOT (1995) fish health guidelines are followed; adherence to artificial propagation, sanitation and disease control practices defined in the policy should reduce the risk of any fish disease or pathogen transfers. WDFW fish health specialists conduct inspections monthly and problems are managed promptly.

6 SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1 Source.

Winter-late adult steelhead returning to the CSH, as identified based on historical run timing and the presence of external adipose fin-clips. The Cowlitz River winter-late steelhead stock was developed from naturally-produced Cowlitz winter steelhead between 1967 – 1970.

6.2 Supporting information.

6.2.1 History.

Broodstock Source	Origin	Year(s) Used	
		Begin	End
Cowlitz River Late Winter Steelhead	N	1967	1970
Cowlitz Trout Hatchery Late Winter Steelhead	H	1971	2012
Lower Cowlitz Hatchery & Wild Late Winter Steelhead	N&H	2013	Present
Upper Cowlitz Wild Late Winter Steelhead	N	2013	Present
Tilton Wild Late Winter Steelhead	N	2013	Present

The Cowlitz River winter-late steelhead stock was developed from naturally produced Cowlitz winter steelhead in the late 1960s. The broodstock specifically targeted April and May spawners to avoid incorporation of early winter steelhead (see description below). Since 1971, adults have been from hatchery identified fish only until 2013. Many of the adult winter steelhead which would have returned to the Cispus, Tilton, and Upper Cowlitz Rivers were collected to establish the Cowlitz Trout Hatchery winter-late stock. The winter-late steelhead finish rearing at the Cowlitz Trout Hatchery and are released into Blue Creek (tributary to Cowlitz River at RKm 66.5), directly below the hatchery.

The construction of Mayfield Dam in 1963 and Mossyrock Dam in 1968 eliminated about 50% of the historical spawning habitat for winter steelhead in the Cowlitz River. Historically, winter-late steelhead populations occurred in the Tilton, Cispus, Upper Cowlitz, lower Cowlitz, North Fork Toutle, South Fork Toutle, and Coweeman Rivers.

The Cowlitz River Fisheries and Hatchery Management Plan proposes to operate hatchery programs rearing salmonids native to the Cowlitz River as "integrated" programs, and all non-native species as Segregated (FHMP update 2011). The Cowlitz River winter-late steelhead stock was developed from naturally produced Cowlitz winter steelhead in the late 1960s. Currently wild winter steelhead are incorporated into the broodstock. The program will continue to provide fish for harvest while minimizing adverse effects on ESA-listed fish. To reduce interactions between hatchery and ESA-listed fish, hatchery production figures throughout the 35 year re-licensing term in the remodeled facility will be established through the Annual Project Review process and the FTC.

6.2.2 Annual size.

Cumulative adult returns/broodstock to the Cowlitz Trout Hatchery and the Cowlitz Salmon Hatchery separator has annually averaged over 1,000 fish/generation in recent years.

Table 6.2.2.1: Adult escapement of winter-late steelhead to Cowlitz Salmon and Trout Hatcheries, 2007-2013.

Return Year	Marked	Unmarked
2007	1,525	641
2008	1,739	507
2009	5,578	494
2010	8,355	613
2011	5,164	642
2012	5,995	648
2013	2,537	922
2014	1,171	208
Average	**4,008**	**584**

Source: WDFW Hatcheries Headquarters Database 2014.

6.2.3 Past and proposed level of natural fish in broodstock.

The Cowlitz River winter-late steelhead stock was developed from naturally produced Cowlitz winter steelhead in the late 1960s. Currently, natural-origin winter steelhead are used in the broodstock program. **See Section 7.4.1**.

6.2.4 Genetic or ecological differences.

Winter steelhead are indigenous to the Cowlitz Basin where they were historically abundant and probably present throughout the watershed (WDW 1990). Small et al. (2010) observed that natural-origin steelhead collected in lower Cowlitz River tributaries were genetically distinct from Cowlitz Hatchery broodstocks but showed genetic influence from hatchery stocks, in particular the non-local early-winter stock. The late-winter steelhead stock produced at Cowlitz Trout Hatchery was derived from native Cowlitz basin steelhead and may include a mixture of formerly distinct populations from drainages upstream of Mayfield Dam. Genetic characteristics (allozyme data) of the winter-late hatchery stock were distinctive compared to the non-native Cowlitz Hatchery winter-early and summer-run stocks, and to other lower Columbia population samples (Phelps et al. 1997). The Cowlitz Hatchery early-winter stock was derived in 1967 from (Puget Sound) early winter-run hatchery stock. The Cowlitz summer-run stock was derived from the Skamania Hatchery early summer stock. Both of these non-local hatchery stocks have been released in other lower Columbia tributaries. These stocks were produced to mitigate for the loss of fish due to hydroelectric dams on the Cowlitz River.

A genetics study conducted by Small et al. (2010) found that:

1. *Un-marked (putative natural-origin) adult steelhead sampled from different tributaries of the lower Cowlitz River are genetically distinct from hatchery-origin steelhead*. Although there has been some hatchery introgression, the natural-origin tributary spawners were different from the hatchery broodstocks.
2. *The genetic profiles of un-marked adult steelhead are distinct among different tributaries*. Steelhead from the Arkansas and Olequa basins are distinct from each other.
3. *Lower Cowlitz tributary natural-origin steelhead are genetically distinct from steelhead in other Cowlitz sub-basins and Lower Columbia tributaries*. The Cowlitz tributary natural-origin steelhead were genetically distinct from all other steelhead in other Cowlitz sub-basin and lower Columbia tributaries, and were closest genetically to the Coweeman

and Elochoman collections. This genetic similarity may be due to sharing founders from the same ancestral population and gene flow among lower Cowlitz tributary groups, and some similarity may be due to introgression in natural spawning populations from a common out-of-basin hatchery stock.

4. *Cowlitz hatchery stocks are genetically distinct among themselves, such that 95% of fish assign back to their stock of origin with high probability*. The hatchery stocks were genetically distinct among themselves and if only fish with greater than 90% relative likelihood of assignment are considered, 95 to 100% of fish assigned back to their stock of origin with high probability. If all fish sampled per broodstock are considered (positively assigned with 90% relative likelihood and ambiguously assigned with less than 90% relative likelihood), the percentage of fish assigning back to their stock of origin changed to: 88% for Cowlitz Hatchery late-winter-run; 86% for Cowlitz Hatchery summer-run; 79% for Cowlitz Hatchery early-winter-run.
5. *Cowlitz hatchery stocks are genetically distinct from other lower Columbia hatchery stocks and wild populations*. The three Cowlitz Hatchery stocks were distinct from the eleven wild or natural-origin steelhead population samples we had for testing. We did not have samples from any other lower Columbia region hatcheries to test.
6. *Un-marked steelhead sampled at the Barrier Dam in 2005 and passed upstream are genetically distinct from the two non-local hatchery stocks, and most similar to the late-winter hatchery stock*.

6.2.5 Reasons for choosing.

Local stock with natural-origin fish adapted to the Cowlitz system.

6.3 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

Only adipose fin-clipped hatchery-origin recruits (HOR) collected at the Cowlitz Salmon Hatchery after April 1 will be selected for broodstock until the final returns of early winter origin stock after the winter of 2014/2015. No more than 30% of the natural origin recruits (NOR) of Tilton origin will be selected for the Tilton integrated program. No more than 30% of the NOR returns of the upper Cowlitz River (UCR) origin will be selected for the UCR integrated program. No more than 30% of the NOR returns to the lower Cowlitz River tributaries will be selected for the lower Cowlitz River integrated program.

7 SECTION 7. BROODSTOCK COLLECTION

7.1 Life-history stage to be collected (adults, eggs, or juveniles).

Adult steelhead arriving at the Cowlitz Salmon Hatchery Separator and lower river tributary weirs.

7.2 Collection or sampling design.

All fish are captured upstream of the Cowlitz Trout Hatchery at the Cowlitz Salmon Hatchery with the exception of the NOR's collected at the lower river tributary weirs. Even though the smolts are raised at the Cowlitz Trout Hatchery a large percentage of the winter-late steelhead by-pass the hatchery outlet at Blue Creek and migrate upstream to the Cowlitz Salmon Hatchery and are captured there. From here, they are transferred to the holding ponds at the Cowlitz Salmon Hatchery.

Broodstock will be comprised of adipose-fin clipped (HOR) adult winter-late steelhead collected and spawned from April 1 through May 20 or later until the final returns of early winter stock

after the winter of 2014/2015. Hatchery origin adults that enter the trap prior to April 1 will be donated to food banks. There will be no selection for size. Right and left ventral clipped or unmarked adults above broodstock needs that are collected will be transported and released in upper watershed and Tilton River for harvest (fin clipped) and reintroduction.

WDFW is conducting a pilot effort to hold, feed and recover to release, female kelts captured at the Cowlitz Falls Fish Facility (CFFF) based on pilot work done by Yakama Nation Fisheries staff (pers. comm. Joe Blodgett, Yakama Nation Fisheries Production Biologist).

7.3 Identity.

Hatchery-origin adipose-fin clipped and natural origin (no fin clip) winter-late adult steelhead are used as broodstock. Fish collected before April 1, are not used in order to avoid potential crosses with early winter steelhead until the final returns of early winter stock after the winter of 2014/2015. To help supplement the reintroduction and restoration effort in the upper watershed, WDFW may transport and release adipose- fin clipped adults collected after April 15 to the upper watershed. This option depends upon the expectation of meeting basic program needs first.

7.4 Proposed number to be collected:

7.4.1 Program goal (assuming 1:1 sex ratio for adults):

Around 234 adults collected annually. The annual egg-take goal is 631,000 for the lower Cowlitz releases (FBD 2013).

An additional 135 adults are needed to meet upper Cowlitz (79) and Tilton River (56) broodstock needs. These programs have an annual egg-take goal of 156,000 and 63,300, respectively.

7.4.2 Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Table 7.4.2.1: Total broodstock collected, by year, 2001-2012.
SH:WL:COWL:H; Late Winter Steelhead, Hatchery Program

Year	Adults		
	Females	Males	Jacks
Origin	HOR	HOR	HOR
2001	244	244	0
2002	233	233	0
2003	129	129	0
2004	165	167	0
2005	143	145	0
2006	160	159	1
2007	149	152	0
2008	131	133	0
2009	168	148	0
2010	417	418	0
2011	92	92	0
2012	138	156	0
	Mixed program		

Source: WDFW Hatcheries Headquarters Database 2014 and Cowlitz Complex Annual Reports.
*Program 519,147 eggs; 1,466,651 eggs taken over program needs as a study group for initial operations of Recirculation Systems A&B.
The hatchery program utilized only adult hatchery origin spawners, identified with an AD-ONLY mark.

Table 7.4.2.2: Total broodstock collected and resultant egg-take, by year, 2013-2014. SH:WL:LCOW:M; Late Winter Steelhead, Mixed Program

Year	Adults						Eggs
	Females		Males		Jacks		
Origin	HOR	NOR	HOR	NOR	HOR	NOR	
2013	118	0	112	2	0	0	684,153
2014	136	5	135	4	0	0	634,587

Integration of the hatchery program (based on HSRG guidelines) with natural-origin stock from the lower Cowlitz River tributaries; Delameter Creek, Ostrander Creek, Lacamas Creek & Olequa Creek. All NOR's are live spawned for this program.

Table 7.4.2.3: Total broodstock collected and resultant egg-take, by year, 2012-2014. SH:WL:TILT:W; Late Winter Steelhead, Wild Tilton Program

Year	Adults						Eggs
	Females		Males		Jacks		
Origin	HOR	NOR	HOR	NOR	HOR	NOR	
2012	0	16	0	34	0	0	81,160
2013	0	15	0	32	0	0	54,640
2014	0	14	0	27	0	0	66,488

This program will be used for harvest and assist in recovery of natural spawning populations of winter steelhead in the Tilton basin. All NOR's are live spawned.

Table 7.4.2.4: Total broodstock collected and resultant egg-take, by year, 2012-2014. SH:WL:UCOW:W; Late Winter Steelhead, Wild Upper Cowlitz River (UCR) Program

Year	Adults						Eggs
	Females		Males		Jacks		
Origin	HOR	NOR	HOR	NOR	HOR	NOR	
2012	13	37	0	50	0	0	222,646
2013	0	33	0	33	0	0	142,000
2014	30	4	31	3	0	0	163,748

This program will be used for harvest and assist in recovery of natural spawning populations of winter steelhead in the upper Cowlitz River basin. All NOR's are live spawned.

7.5 Disposition of hatchery-origin fish collected in surplus of broodstock needs.

Adult winter-late steelhead that returned to the Cowlitz Salmon Hatchery separator are sorted and those fish designated for the upper watershed are placed in holding tanks. These are later transported and released by Tacoma Power at the boat launch to Lake Scanewa at the LCPUD Day Use Park or the Gus Backstrom Park on the Tilton River. The FHMP places no limits on the number of HOR winter-late steelhead released into the upper Cowlitz or Tilton River from the integrated program returns. More than 8,000 adult winter-late fish have been transported upstream since 1997 (**see section 1.12**).

7.6 Fish transportation and holding methods.

Cowlitz Salmon Hatchery. Winter-late steelhead trapped at the Cowlitz Salmon Hatchery are sorted as they arrive to the Separator to the adult holding ponds or to one of the six circular transfer tanks. These tanks are designed to hold up to 1,250 pounds of fish. The facility has three

1,500 gallon tanker trucks capable of hooking to the underside of the circular tanks and receiving fish through displacement of water. This process results in low-stress transfer for the adult fish.

See also HGMP section 5.3.

7.7 Describe fish health maintenance and sanitation procedures applied.

Integrated Hatchery Operations Team (IHOT), *Pacific Northwest Fish Health Protection Committee* (PNFHPC), WDFW's *Fish Health Manual* (November 1966, updated March 1998, revised March 2010) or Co-manager guidelines are followed. The adult holding area is separated from all other hatchery operations. All equipment and personnel use disinfection including chlorine, Virkon® or iodophor procedures upon entering or exiting the area. Formalin treatments are administered if needed.

Formalin treatments at 1:10,000 ppm are administered twice weekly during the adult-holding period.

7.8 Disposition of carcasses.

Spawned carcasses of late winter-run steelhead are considered inedible and are buried. Carcasses are not used in nutrient enhancement, primarily for disease (IHNV) concerns.

7.9 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Fish of non-hatchery origin (unmarked) not retained for broodstock will be transported upstream in a manner which will not harm them.

8 SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1 Selection method.

Broodstock will be comprised of unmarked natural origin and adipose-fin clipped adult winter-late steelhead collected and spawned over the curve of the run. Hatchery origin fish are collected from April 1 through the end of the season (May 20 or later) until the final returns of early winter stock fish (winter 2014/2015). Multiple takes of up to seven takes can be spawned. New fish will be recruited into the spawning population throughout this time period.

8.2 Males.

Males will be used once unless a shortage exists. All natural origin fish will be live spawned and returned to the river or tributary of origin.

8.3 Fertilization.

Fertilization will follow factorial mating guidelines as appropriate for each program (see below). After five minutes, the fertilized eggs (from one female) are disinfected and water hardened in an iodine solution for one hour. After one hour, the eggs placed into vertical incubation trays to incubate.

COWLITZ LATE WINTER STEELHEAD BROODSTOCK SPAWNING GUIDLINES

- Randomize mating and avoid selectivity beyond ripeness on a given spawn day.
- Preferred Matrix for Tilton Stock = 2 Males X 1 Female

- Preferred Matrix for Upper Cowlitz Stock = 2 Males X 2 Females

- Only pooling eggs of a like female after 30 second fertilization with the primary male allowed for the back-up.
- Do not mix milt from multiple males and add to eggs (pooling prior to mixing) in order to eliminate disproportionate genetic male contributions.
- Do not re-use males.
- All wild adults after live spawning and/or ripe female with no male will be returned to river or tributary of origin.

Table 1. Spawning Broodstock of more than 50 pairs i.e. hatchery brood stock(Modified from Eddy et al, 1996)

<table>
<tr><th>Sex Ratio</th><th colspan="6">Spawning Protocol</th><th>Back-Up</th><th></th></tr>
<tr><td>Equal sex ratio:

Program applications:

SH:WL:H

Lower Cowlitz Stock</td><td colspan="6">Spawn 1x1

<table><tr><td colspan="2" rowspan="2"></td><td colspan="4">Female</td></tr><tr><td>W</td><td>X</td><td>Y</td><td>Z</td></tr><tr><td rowspan="4">Male</td><td>A</td><td>AW</td><td></td><td></td><td></td></tr><tr><td>B</td><td></td><td>BX</td><td></td><td></td></tr><tr><td>C</td><td></td><td></td><td>CY</td><td></td></tr><tr><td>D</td><td></td><td></td><td></td><td>DZ</td></tr></table></td><td>In-direct back-up:

Only pooling eggs after fertilization with the primary male allowed.</td><td></td></tr>
</table>

Table 2. Spawning Broodstock of more than 50 pairs with needed genetic diversity i.e. wild brood stock (Modified from Eddy et al, 1996).

<table>
<tr><th>Sex Ratio</th><th>Spawning Protocol</th><th>Back-Up</th><th></th></tr>
<tr>
<td>Equal sex ratio

Program applications:

SH:WL:W

Upper Cowlitz Stock</td>
<td>Spawn 2 x 2 PREFERED

<table>
<tr><td colspan="2" rowspan="2"></td><td colspan="2">Female</td></tr>
<tr><td>X</td><td>Y</td></tr>
<tr><td rowspan="2">Male</td><td>A</td><td>AX</td><td>AY</td></tr>
<tr><td>B</td><td>BX</td><td>BY</td></tr>
</table>

Spawn 3 x 3

<table>
<tr><td colspan="2" rowspan="2"></td><td colspan="4">Female</td></tr>
<tr><td>X</td><td>Y</td><td>Z</td><td></td></tr>
<tr><td rowspan="4">Male</td><td>A</td><td>AX</td><td>AY</td><td>AZ</td><td></td></tr>
<tr><td>B</td><td>BX</td><td>BY</td><td>BZ</td><td></td></tr>
<tr><td>C</td><td>CX</td><td>CY</td><td>CZ</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td>
<td>In-direct back-up:

Only pooling eggs of a like female after fertilization with the primary male allowed.</td>
<td>Maximum of

3 x 3

Spawn Scheme

4 x 4 Take spawn two, 2 x 2 matrixes.

Spawn Scheme

3 x 2 Take away a male and spawn a 2 x 2 matrix.</td>
</tr>
</table>

Table 3. Spawning Broodstock of less than 50 pairs with needed genetic diversity i.e. wild brood stock (Matrix, Modified from Eddy et al, 1996)

<table>
<tr><th>Sex Ratio</th><th>Spawning Protocol</th><th>Back-Up</th><th></th></tr>
<tr>
<td>Unequal sex ratio

Program applications:

SH:WL:W

Tilton Stock</td>
<td>Spawn 2 x 1 PREFERED
<table>
<tr><td colspan="2"></td><td>Female</td><td></td><td></td><td></td></tr>
<tr><td colspan="2"></td><td>X</td><td></td><td></td><td></td></tr>
<tr><td rowspan="4">Male</td><td>A</td><td>AX</td><td></td><td></td><td></td></tr>
<tr><td>B</td><td>BX</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
Spawn 1 x 2
<table>
<tr><td colspan="2"></td><td>Female</td><td></td><td></td><td></td></tr>
<tr><td colspan="2"></td><td>X</td><td>Y</td><td></td><td></td></tr>
<tr><td rowspan="4">Male</td><td>A</td><td>AX</td><td>AY</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
</table>
Spawn 2 x 3
<table>
<tr><td colspan="2"></td><td>Female</td><td></td><td></td><td></td></tr>
<tr><td colspan="2"></td><td>X</td><td>Y</td><td>Z</td><td></td></tr>
<tr><td rowspan="4">Male</td><td>A</td><td>AX</td><td>AY</td><td>AZ</td><td></td></tr>
<tr><td>B</td><td>BX</td><td>BX</td><td>BZ</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td>
<td>In-direct back-up:

Only pooling eggs of a like female after fertilization with the primary male allowed.</td>
<td>Maximum of

Spawn Scheme

3 x 1 Take away a male and spawn a 2 x 1 matrix.

Spawn Scheme

4 x 2 Take spawn two, 2 x 1 matrixes.</td>
</tr>
</table>

Spawn 3 x 2

		Female			
		X	Y		
Male	A	AX	AY		
	B	BX	BY		
	C	CX	CY		

8.4 Cryopreserved gametes.

This program does not use cryopreserved gametes.

8.5 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

- See Spawning Guidelines in section 8.3.
- There will be no selection for size.
- Right or left ventral clipped fish will be transported and released in the upper watershed or Tilton River for harvest and reintroduction. Unmarked adults not collected for broodstock will be transported and released in the upper watershed or Tilton River to spawn.

9 SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1 Incubation:

9.1.1 Number of eggs taken and survival rates to eye-up and/or ponding.

Table 9.1.1.1: Survival rates (%) from egg-take to ponding, by year, 2002-2012.
SH:WL:COWL:H; Late Winter Steelhead, Hatchery Program

Year	Egg-Take	Eyed Eggs	% Survival	Ponded	% Survival
2002	1,110,069	975,314	87.9	929,671	95.3
2003	867,694	692,448	79.8	662,009	95.6
2004	725,546	662,429	91.3	635,216	95.9
2005	825,537	717,529	86.9	621,815	86.7
2006	840,400	763,864	90.9	733,001	95.9
2007	812,816	718,059	88.3	687,442	95.7
2008	767,167	679,938	88.6	648,132	95.3
2009	799,553	691,581	86.5	672,620	97.3
2010	*1,985,798	1,227,417	61.8	*1,116,397	90.9
2011	583,442	544,908	93.4	516,797	94.8
2012	716,981	620,398	86.5	604,275	97.4
2013	**Integration of Program**				
Average					

Source: WDFW Annual Escapement Reports and Hatcheries Headquarters Database 2014.
NA – Not available
Eyed eggs total includes egg shortage/overage.
*Program 519,147 eggs; 1,466,651 eggs taken over program needs as a study group for initial operations of Recirculation Systems A&B.

Table 9.1.1.2: Survival rates (%) from egg-take to ponding, by year, 2013-2014.
SH:WL:LCOW:M; Late Winter Steelhead, Mixed Program

Year	Egg-Take	Eyed Eggs	% Survival	Ponded	% Survival
2013	684,153	632,774	92.5	615,222	97.2
2014	634,587	NA	NA	NA	NA

Integration of the hatchery program (based on HSRG guidelines) with natural origin stock from the lower Cowlitz River tributaries; Delameter Creek, Ostrander Creek, Lacamas Creek & Olequa Creek.

Table 9.1.1.3: Survival rates (%) from egg-take to ponding, by year, 2013-2014.
SH:WL:TILT:W; Late Winter Steelhead, Wild Tilton Program.

Year	Egg-Take	Eyed Eggs	% Survival	Ponded	% Survival
2012	81,160	65,236	80.4	64,789	99.3
2013	54,640	47,740	87.4	44,004	92.2
2014	66,488	NA	NA	NA	NA

This program will be used for harvest and recovery of natural spawning populations of winter steelhead in the Tilton basin.

Table 9.1.1.4: Survival rates (%) from egg-take to ponding, by year, 2013-2014.
SH:WL:UCOW:W; Late Winter Steelhead, Wild Upper Cowlitz River (UCR) Program

Year	Egg-Take	Eyed Eggs	% Survival	Ponded	% Survival
2012	222,646	162,477	72.9	159,018	97.9
2013	142,200	107,991	75.9	106,389	98.5
2014	163,748	NA	NA	NA	NA

This program will be used for harvest and recovery of natural spawning populations of winter steelhead in the upper Cowlitz River basin.

9.1.2 Cause for, and disposition of surplus egg takes.

The program has protocols and procedures to prevent surpluses. But, in case of a surplus, eggs would be incubated and reared full-term to fry or smolt, and surplus/overage of fish would be dispersed in the sub-basin based on consultation with regional manager and NOAA Fisheries.

9.1.3 Loading densities applied during incubation.

Cowlitz Trout Hatchery. The incubation of eggs in shallow troughs at the CTH is not currently conducted. Historically eggs from five-fish pools are incubated in baskets in shallow troughs, until eyed. Fish are then reloaded at 20,000-21,000 eyed eggs per trough for hatching. Egg size varies but averages 3,600 per pound (3-year average).

Cowlitz Salmon Hatchery. Currently the incubation of eggs is conducted at the CSH recirculation systems A&B egg trays. Eggs from hatchery stock are incubated in two-fish pools in egg trays and are laid down to eye and hatch at 10,000 eggs per tray. Eggs from wild stocks are incubated in a one-fish pool in egg trays

9.1.4 Incubation conditions.

Cowlitz Trout Hatchery. The facility has 88 shallow trough incubators which are supplied by well water which are not currently being used. Five new gas diffusers, packet columns were installed in 2002 to correct the supersaturated gas and low oxygen levels from the north well (primary incubation supply) and south well water supply. Temperature of the wells water normally runs 48 - 50°F. The north well was inundated with bacteria thus has not been utilized since fall 2000. Tacoma Power installed an auxiliary power generator to the south wells.

Cowlitz Salmon Hatchery. Currently the incubation of eggs is conducted at the CSH recirculation systems A&B egg trays. The incubation of steelhead stocks in vertical stacks/egg trays on Recirculation Systems A&B on ground water via once thru mode (fresh supply) or on recirculation mode (reclaimed supply with added fresh or makeup supply). Flow, temperature, and dissolved oxygen readings are monitored.

9.1.5 Ponding.

Cowlitz Trout Hatchery. Currently not being used. The Cowlitz Trout Hatchery has 88 shallow troughs where sac fry merge from the egg baskets. Ponding or feeding is initiated for steelhead at 1,200 temperature units (TU's) when unfed fry are about 2,500 fish per pound (fpp) and for cutthroat at 1,050 TU's when unfed fry are about 6,500 fpp. Ponding begins in mid-February continuing into March, and is based on visual inspection of the amount of yolk remaining. Flow, temperature and dissolved oxygen readings are monitored.

Cowlitz Salmon Hatchery. Currently at the CSH, all steelhead and cutthroat programs are ponded as unfed fry from incubation egg trays to the rearing troughs utilizing recirculation systems A&B. Ponding or feeding is initiated for steelhead at 1,200 temperature units (TU's) when unfed fry are

about 2,500 fish per pound (fpp) and for cutthroat at 1,050 TU's when unfed fry are about 6,500 fpp. Ponding begins in mid-February continuing into March, and is based on visual inspection of the amount of yolk remaining. Flow, temperature and dissolved oxygen readings are monitored.

9.1.6 Fish health maintenance and monitoring.

Standard fish health protocols are followed as defined in the *Fish Health Manual* (WDFW November 1966; updated March 1998; revised March 2010).

Cowlitz Trout Hatchery. Feeding fry diseases include Bacterial Cold Water Disease (BCWD), bacterial gill disease and *Trichodina*. Standard fish health protocols are followed as defined in the *Fish Health Manual* (WDFW revised March 2010).

Cowlitz Salmon Hatchery. Unfed and feeding fry diseases on recirculation systems A&B include Bacterial Cold Water Disease (BCWD), Bacterial Gill Disease (BGD) and gut fungus. Standard fish health protocols are followed as defined in the *Fish Health Manual* (WDFW revised March 2010).

Saprolegniasis (fungus) is the primary concern during incubation, requiring daily treatments with formalin at 1:600 for 15 minutes.

9.1.7 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

Families within spawning groups are mixed randomly at ponding so that unintentional rearing differences affect families equally. Disinfection procedures are implemented during incubation that prevents pathogen transmission between stocks of fish on site.

Backup generator systems are on-site to provide power for hatchery water supplies in the event of power loss at both the Cowlitz Salmon and Cowlitz Trout hatcheries.

9.2 Rearing:

9.2.1 Provide survival rate data (*average program performance*) throughout hatchery life stages (fry, fingerling, sub-yearling, yearling to smolt) to release for the most recent twelve years (2002-12), or for years dependable data are available.

Table 9.2.1.1: Survival rates (%) from ponding to release, Cowlitz Trout Hatchery. SH:WL:COWL:H; Late Winter Steelhead, Hatchery Program

Brood Year	Population Ponded	Total Released	% Survival
2002	929,671	872,032	93.8
2003	662,009	552,826	83.5
2004	635,216	490,338	77.2
2005	621,815	402,479	64.7
2006	733,001	550,279	75.1
2007	687,442	628,892	91.5
2008	648,132	615,999	95.0
2009	672,620	**600,672	89.3
2010	*1,116,397	*1,036,124	92.8
2011	516,797	386,025	74.7
2012	604,275	498,735	82.5
Average			

Source: WDFW Annual Escapement Reports and Hatcheries Headquarters Database 2014.

NA – Not available
*Study group for initial operations of Recirculation Systems A&B; CTH Program 379,347 smolt release, 656,777 sub-yearlings planted into Riffe Lake.
**Program change; CTH Program 408,458 smolt release, 46,957 shipped to Kalama Hatchery & 145,257 sub-yearlings planted into Riffe Lake.

Table 9.2.1.2: Survival rates (%) from ponding to release, Cowlitz Trout Hatchery. SH:WL:LCOW:M; Late Winter Steelhead, Mixed Program

Brood Year	Population Ponded	Total Released	% Survival
2013	615,222	588,893	95.72
2014	NA	NA	NA

Table 9.2.1.3: Survival rates (%) from ponding to release, Cowlitz Trout Hatchery. SH:WL:TILTON:W; Late Winter Steelhead, Tilton River Program

Brood Year	Population Ponded	Total Released	% Survival
2012	64,789	52,292	80.7
2013	44,004	41,679	94.72
2014	NA	NA	NA

Table 9.2.1.4: Survival rates (%) from ponding to release, Cowlitz Trout Hatchery. SH:WL:UCOW:W; Late Winter Steelhead, Wild Upper Cowlitz River (UCR) Program

Brood Year	Population Ponded	Total Released	% Survival
2012	159,018	138,103	86.9
2013	106,389	104,113	97.86
2014	NA	NA	NA

9.2.2 Density and loading criteria (goals and actual levels).

Table 9.2.2.1: Density and loading levels in Cowlitz Trout Hatchery rearing ponds.

Stage	Container		Loading		Water	
	Type	Size	Number Fish	Size (fpp)	Flow (gpm)	Quality
Starting	Concrete trough	7.2 cu. ft.	20,000	2,500	10	One pass
Initial Rearing	Concrete raceway	10’x80’	200,000	1,500	200	One pass
		20’x100’	400,000	700	300	Fresh and re-use
Final Grow-out	Rearing ponds	5.0-acre	350,000	5.5	5,000	Fresh and re-use
		2.5-acre	350,000	8.0	5,000	
	Concrete raceway	20’x100’	35,000-40,000	5.5	900	Re-use

Cowlitz Trout Hatchery: Fish are started in concrete troughs with 7.2 cu. ft. of water capacity, loaded with an average of 20,000 fry and steelhead at 2,500 fpp and cutthroat at 6,500 fpp. Initial rearing occurs in either the 10' X 90’ or 20' X 90' concrete raceways, with final grow-out in the 20-ft raceways and 5.0-acre or 2.5-arce acre rearing ponds. The 10-ft wide raceways are started

with up to 200,000 fish at 1,500 fpp. Twenty-foot wide raceways are started with 400,000 fish maximum at 700 fpp; as fish increase in size, the numbers are reduced to a final loading number of 6,000 pounds of fish per 20-ft wide raceway. Loading is 65,000 pounds of fish in the 5.0-acre lakes and 45,000 pounds of fish in the 2.5-acre lake.

Table 9.2.2.2: Density and loading levels in Cowlitz Salmon Hatchery rearing ponds.

Stage	Container		Loading		Water	
	Type	Size	Number Fish	Size (fpp)	Flow (gpm)	Quality
Starting Recirculation Systems A&B	Rearing trough-9	477 cu. ft.	150,000	2,500 & 6,500	90	Recirculation supply
	Rearing trough-3	152 cu. ft.	40,000	2,500 & 6,500	45	Recirculation supply & One pass

Cowlitz Salmon Hatchery: On recirculation systems A&B fish are started and initial reared in fiberglass troughs. The 9 larger rearing troughs have 477 cu. ft. of water capacity and loaded with an average of 150,000 fry and the 3 smaller troughs at 40,000 fry. Once flow and density indexes are met in the rearing vessels the fish stocks are either split to adjacent troughs or the fish are transported to the Cowlitz Trout Hatchery to complete initial rearing and final grow out.

9.2.3 Fish rearing conditions.

Cowlitz Trout Hatchery: Water flow in the shallow troughs is 10 gallons per minute (gpm). Water is one-time pass-through in the 10-ft wide raceways, but 20-ft wide raceways may use re-use water. Raceways and rearing ponds receive both fresh and previously-used water.

Due to dependence on limited ozonated and well water during a significant period of the rearing cycle (mid-May through late December), water must be re-used multiple times to achieve production goals during the final grow out period. January to mid-May the facility operates on all four river pumps and all raceways receive fresh water and the rearing ponds receive both fresh and previously-used water. Oxygen levels are normally greater than 10 ppm with incoming river water. Water temperatures range between 40-54°F.

Raceways are cleaned on average once per week throughout their rearing. The rearing ponds have a settling basin that is cleaned by divers via septic tank truck within one week from final drawdown. The effluent of both goes into a pollution abatement pond.

Cowlitz Salmon Hatchery: Fish numbers ponded into the rearing troughs are based on density and flow indexes at maximum growth. When density and/or flow indexes are met the fish are either split into adjacent troughs or transferred to the Cowlitz Trout Hatchery. Flows are increased by fish size and growth to optimize feeding and cleaning conditions. Water supply in the rearing troughs is normally operated in recirculation mode. If treatments (excluded medicated feed) are administered such as hydrogen peroxide the recirculation system A or B has to be switched to the one pass flow and directed to the plant drain. The administered chemical would destroy the bacteria in the recirculation system (sand filters) that removes ammonia toxins. During the highest demand and/or loadings there is not enough well water supply for one pass for a sustained period of time. Toughs are cleaned daily; waste is discharged to the sand filters via internal plumbing and flushed to the pollution abatement pond every other day or daily dependent on loadings. Flow, temperature, dissolved oxygen and water quality readings are monitored daily.

9.2.4 Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Table 9.2.4.1: Monthly fish growth, by length (mm), weight (fpp), condition factor and growth rate, Cowlitz winter-late steelhead programs.

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate
June- At Swim-up	n/a	2,500	n/a	n/a
July	34	1,500	n/a	0.400
August	42	600	3.712 E-04	0.600
September	57	250	4.129 E-04	0.583
October	72	125	4.406 E-04	0.500
November	86	75	4.435 E-04	0.400
December	101	45	4.025 E-04	0.400
January	116	30	4.294 E-04	0.333
February	133	20	4.125 E-04	0.333
March	146	15	3.919 E-04	0.250
April	188	7.0	3.930 E-04	0.533

Note: In recent years, the Cowlitz Trout Hatchery has been unable to achieve a final goal of 5.5 fish/lb by the April release date. Actual release size achieved is approximately 7.0 fish/lb.

9.2.5 Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

See 9.2.4.1.

9.2.6 Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Table 9.2.6.1: Food type and feeding rate, by rearing period.

Rearing Period	Food Type	Application Schedule (#feedings/day)	Feeding Rate Range (%B.W./day)	Lbs. Fed Per gpm of Inflow	Food Conversion During Period
Swim-up fry	Mash #1	7	4.0		0.5
Fry	#1 and #2 crumble	7	2.5-4.0		0.6
Fingerling	1.2 mm and 1.5 mm	6	1.5-4.0		0.7
Yearling	2.0 mm	5-6	2.0-3.0		0.8
Smolt	2.5 mm	5-7	3.0		1.0

9.2.7 Fish health monitoring, disease treatment, and sanitation procedures.

Fish health is monitored on a daily basis by hatchery staff and at least monthly by a WDFW Fish Health Specialist. Hatchery personnel carry out treatments prescribed by the Fish Health Specialist. Procedures are consistent with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006), *Fish Health Policy in the Columbia Basin* and *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 5, IHOT 1995). A fish health specialist stationed at Cowlitz Complex inspects fish programs and checks both healthy and if present symptomatic

fish. External signs such as lesions, discolorations, and fungal growths will lead to internal examinations of skin, gills and organs. Blood is checked for signs of anemia or other pathogens. Additional tests for virus or parasites are done if warranted. All eggs brought to the facility are surface-disinfected with iodophor, per disease policy guidelines.

In the standard ponds, fry and fingerlings have been treated with florfenicol for Bacterial Cold Water Disease (BCWD), hydrogen peroxide for Bacterial Gill Disease (BGD) and Parasite-S for external parasites, fungus and *Trichodina.* Adults have been treated with Parasite-S for external parasites and fungus control. Infectious Hematopoietic Necrosis Virus (IHNV) from adults can cause low-level chronic mortalities during the rearing period. Formalin baths were also given after marking to prevent CWD and fungus from infecting the clipped area. Fish health and/or treatment reports are kept on file.

The lower Cowlitz River appears to harbor the polychaete worm, an intermediate host *Ceratomyxa shasta,* which causes *Ceratomyxosis*. *C. shasta* may become established by the introduction of infected fish or infective water into the area wherever this worm exists. Wild and hatchery fish may contract this disease as they migrate through the lower river.

Mortalities are collected and disposed of at a landfill. All equipment (nets, tanks, boots, etc.) are disinfected with Virkon® or iodophor between different fish/egg lots. Different fish/egg lots are physically isolated from each other by separate ponds or incubation unit, with the intent of preventing the horizontal spread of pathogens. Tank trucks are disinfected between the fish transports. Foot baths containing disinfectant are strategically located on the hatchery grounds to prevent spread of pathogens.

See also HGMP section 10.9 for WDFW Standard Fish Health Procedures.

9.2.8 Smolt development indices (e.g. gill ATPase activity), if applicable.

The migratory state of the release population is determined by fish behavior. Aggressive screen and intake crowding, leaner condition factors, a more silvery physical appearance and loose scales during feeding events are signs of smolt development. ATPase activity is not measured.

9.2.9 Indicate the use of "natural" rearing methods as applied in the program.

No "NATURES" type rearing methods are currently applied through the program, although there have been previous efforts in the past (see HGMP section 11).

9.2.10 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

An ozone water sterilization plant is available for use during portions of the year. The plant has a 20 cfs maximum design capacity. The purpose of this plant is to reduce the mortality and poor growth of fish associated with *Ceratomyxa shasta* (*C. shasta*) infection.

Hatchery fish are reared to meet *Statewide Steelhead Rearing and Release Guidelines* (Tipping 2001) to achieve a size and condition factor at the time of releases that represents the best chance for survival in order to meet adult goals. Rearing fish to a yearling smolt stage is mandatory in order to foster out-migration and subsequent survival when the fish vacate the system. Fry or sub-yearlings will not be reared and released from this program in order to eliminate or minimize interactions with listed fish rearing in the system.

All reasonable and prudent measures are employed to minimize rearing and incubation losses. These include the use of well water for incubation and early rearing of fry, high quality feeds for rearing, rearing densities and loadings that conform to best management practices, frequent fish health inspections and presence of professionally trained personnel to operate facilities. Hatcheries are designed to provide safe and secure rearing environment through the use of alarm systems, backup generators and water re-use pumping systems to prevent catastrophic fish losses.

10 SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1 Proposed fish release levels.

Table 10.1.1: Proposed release levels.

Age Class	Max. No.	Size (fpp)	Release Date	Location	
				Stream	Release Point (RKm)
Yearling	480,000[a]	5.5	Apr - May	Lower Cowlitz	66
	118,000[b]	5.5	Apr - May	Lower Cowlitz	66
	48,000[c]	5.5	Apr - May	Lower Cowlitz	66

Source: WDFW Future Brood Document 2013
Note: 5.5 fpp = 204 mm fork length (fl)
[a]. Approximate.
[b] Upper Cowlitz stock.
[c] Tilton River (WRIA 26.0560) stock.

10.2 Specific location(s) of proposed release(s).

Stream, river, or watercourse: Cowlitz River (WRIA 26.0002)

Release point(s): RKm 66 and 140

Major watershed: Cowlitz Sub-Basin

Basin or Region: Lower Columbia River

10.3 Actual numbers and sizes of fish released by age class through the program.

Table 10.3.1: Releases into the Upper Cowlitz River, Cowlitz Trout Hatchery 2002-2013. SH:WL:COWL:H; Late Winter Steelhead, Hatchery Program.

Release Year	Sub-yearlings			Yearlings		
	Number	Avg. Size (fpp)	Date Released	Number	Avg. Size (fpp)	Date Released
2002	171,951	88.3	Sept. 24	37,359	9.3	May 14-15
2003	299,733	52.2	9/30-Oct. -9	31,768	11.5	April 28-29
2004	199,704	85.5	Oct. 5-7	24,864	6.9	May 11
2005	50,068	71.7	Oct. 25-27	71,681	7.3	May 10
2006	198,841	39.8	Oct. 31-Nov. 2	36,913	8.0	April 17-May 11
2007	203,390	53.2	Oct. 23-Nov. 1	46,857	10.1	April 23-24
2008	188,777	83.8	Oct. 29	55,430	10.0	April 21-24
2009	**Discontinued**			33,615	8.5	May 4-6
2010				0		
2011				0		
2012				0		
2013				0		

Source: WDFW Hatcheries Headquarters Database 2010, 2014.
Note: 5.5 fpp ~205 mm fork length (fl); 10.0 fpp ~167 mm fl.
40.0 fpp ~105 mm fork length (fl); 85 fpp ~82mm fl; 143 fpp ~69 mm fl.

Table 10.3.2: Releases into the Lower Cowlitz River, Cowlitz Trout Hatchery 2002-2013. SH:WL:COWL:H; Late Winter Steelhead, Hatchery Program

Release Year	Sub-yearlings			Yearlings		
	Number	Avg. Size (fpp)	Date Released	Number	Avg. Size- (fpp)	Date Released
2002	0	0		408,650	8.9	May 6-15
2003	0	0		335,334	10.7	May 1-5
2004	0	0		228,229	6.7	May 5-10
2005	0			218,953	8.0	May 3-12
2006	0			315,498	7.7	Apr 15-May 19
2007	0			304,581	8.3	Apr 15-May 15
2008				370,072	8.8	Apr 15-30
2009	Discontinued			393,607	9.3	May 4-20
2010				408,458	8.8	Apr 19, May 20
2011				379,347	8.2	Apr 15-30, May 1-15
2012				386,025	9.5	Apr 3, Apr 15-May 15
2013				498,735	9.1	Apr 15-May 15

Source: Mark Johnson (WDFW) 2010, WDFW Hatcheries Headquarters Database 2014.
Note: 5.5 fpp ~205 mm fork length (fl); 7.5 fpp ~184 mm; 10.0 fpp ~167 mm fl mm fl.
50.0 fpp ~92 mm fork length (fl); 85 fpp ~82mm fl.

Table 10.3.3: Releases into the Lower Cowlitz River, Cowlitz Trout Hatchery 2013-2014.SH:WL:LCOW:M; Late Winter Steelhead, Mixed Program

Release Year	Sub-yearlings			Yearlings		
	Number	Avg. Size (fpp)	Date Released	Number	Avg. Size- (fpp)	Date Released
2013	No Program					
2014	0	0		588,893	8.7	4/15/-5/20

First plant of program will be April-May 2014.

Table 10.3.4: Releases into the Lower Cowlitz River, Cowlitz Trout Hatchery 2012-2014. H:WL:TILT:W; Late Winter Steelhead, Tilton River Program.

Release Year	Sub-yearlings			Yearlings		
	Number	Avg. Size (fpp)	Date Released	Number	Avg. Size- (fpp)	Date Released
2012	No Program					
2013	0	0		52,292	7.6	4/15-5/20
2014	0	0		41,679	9	4/15/-5/20

Table 10.3.5: Releases into the Lower Cowlitz River, Cowlitz Trout Hatchery 2012-2014. SH:WL:UCOW:W; Late Winter Steelhead, Upper Cowlitz River (UCR) Program.

Release Year	Sub-yearlings			Yearlings		
	Number	Avg. Size (fpp)	Date Released	Number	Avg. Size- (fpp)	Date Released
2012	No Program					
2013	0	0		138,103	8.5	4/15-5/20
2014	0	0		104,113	8.9	4/15-5/20

10.4 Actual dates of release and description of release protocols.

See **Table 10.3.1** and **Table 10.3.2** for actual dates.

Cowlitz Trout Hatchery (CTH); Releases begin April 15 and are completed by May 20. Releases start volitionally. All four ponds share a common counting structure, and therefore must share the release period to enumerate species, and/or races. Remaining fish that did not volitional are forced out after the lakes are lowered and drained in May. Direct releases from the Cowlitz Trout Hatchery raceways are not possible, and fish must be trucked to Blue Creek or the Cowlitz River via Blue Creek boat launch.

All the late winter steelhead stocks (integrated "mixed" hatchery stock, Tilton and UCR) are all planted at the CTH, lower Cowlitz River. There are currently no upper river plants.

10.5 Fish transportation procedures, if applicable.

Juvenile fish being released or transferred between facilities, utilize the 1,500 gallon fish tanker assigned to the Cowlitz Trout Hatchery. The vehicle has oxygen and recirculation systems. In addition, several smaller tankers equipped with air stones (one 750 gallon, one 1,000 gallon fiberglass tank and several 250 gallon tanks) are utilized for moving fish around and between the facilities (see HGMP section 5.2).

10.6 Acclimation procedures (methods applied and length of time).

At CTH, fish have been reared in the facilities most of their yearling cycle and directly released into Blue Creek. River water has been used most of the rearing cycle with ozone treated water used from May to late December.

10.7 Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

All winter-late steelhead smolts released from the Cowlitz Complex are adipose fin-clipped prior to release. Releases of the upper Cowlitz and Tilton rivers stocks are differentiated by an additional ventral fin-clip (**Table 10.7.1**)

Table 10.7.1: Marks applied, by age and release location.

Brood year	Yearlings	Mark Type	Release Location
2014	480,000 (LCOW stock)	Ad-only	Lower Cowlitz
	118,000 (UCOW stock)	AD+RV	Lower Cowlitz
	48,000 (TILT stock)	AD+LV	Lower Cowlitz

Source: WDFW Future Brood Document 2014.

10.8 Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

The program guidelines for annual broodstock/egg-take collection are managed to prevent any surpluses, and maintained within the ±5% guideline. In the event of surplus >10%, WDFW Regional Managers will in accordance with regional policy and guidelines set forth in management plans/agreements and ESA permits, and after consultation with NMFS, instruct hatchery staff for disposition of the surplus.

10.9 Fish health certification procedures applied pre-release.

Standard Fish Health Procedures performed at the facility:

- *All fish health monitoring is conducted by a qualified WDFW Fish Health Specialist.*
- *Juvenile fish examinations are conducted at least monthly and more often if necessary*. A representative sample (at the discretion of the fish health specialist) of healthy and moribund fish from each lot is examined.

- *Abnormal levels of fish loss are investigated if they occur.*
- *Fish health status is determined prior to release or transfer to another facility*. The exam may occur during the regular monthly monitoring visit, i.e. within one month of release or transfer.
- *Appropriate actions, including drug or chemical treatments are recommended as necessary*. If a bacterial pathogen requires treatment with antibiotics a drug sensitivity profile is be generated when possible.
- *Findings and results of fish health monitoring are recorded on a standard fish health reporting form and maintained in a fish health database.*
- *Fish culture practices are reviewed as necessary with facility personnel*. Where pertinent; nutrition, water flow and chemistry, loading and density indices, handling, disinfecting procedures and treatments are discussed.

10.10 Emergency release procedures in response to flooding or water system failure.

In the case of a catastrophic event, conditions critical to the fish's health would be monitored, however, fish would not be purposely released during flooding unless the water system failed. At the Cowlitz Trout Hatchery, fish in the raceways cannot be released directly into the river and would need to be pumped to trucks or to the river; time would be limited due to the large number of ponds.

10.11 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

WDFW has taken following actions to minimize adverse genetic and ecological effects to listed species resulting from hatchery releases:

- Eliminated egg transfers between watersheds.
- Eliminated off-station releases where no trapping facilities are available.
- Limiting recycling fish back into the river for sport fishing opportunities.
- Eliminated fry and sub-yearling releases, and mandatory rearing; release only yearling smolts, which are in migratory condition. This promotes rapid out-migration and thus minimizes the time spent in the river, in order to minimize or eliminate interactions with natural-origin salmonids rearing in the system (*Statewide Steelhead Rearing and Release Guidelines*; Tipping 2001).
- Promoted volitional releases to foster rapid seaward migration and limit freshwater interactions with listed Chinook and steelhead juveniles, bull trout and other naturally-produced salmonids.
- Mass-mark all releases for harvest selection and removal from the system.
- Release fish no earlier than April 15, to allow listed stocks (Chinook, chum and steelhead) and pink salmon, to emigrate out of the system, and/or provide time for additional growth to minimize potential predation.
- Continue monitoring, research and reporting of hatchery smolt migration performance behavior, and interactions with wild fish to assess and adjust, if necessary, hatchery production and release strategies to minimize effects on wild fish.

Hatchery steelhead releases have been 100% mass-marked since 1980s to enable identification during selective harvest, broodstock selection and, most recently, removal from the system.

WDFW continues monitoring, research and reporting of hatchery smolt migration performance behavior, and interactions with natural-origin fish to assess and adjust, if necessary, hatchery production and release strategies to minimize effects on natural-origin fish. WDFW is conducting

research on the effects of volitional releases in upper Columbia basin. This study is not yet fully completed, but preliminary results suggest faster fish migration, and lower rates of residualism when released volitionally (Snow et al. 2013).

With changes already being implemented, WDFW continues monitoring its hatchery programs and the affected watersheds to observe the effects on the populations at the hatcheries and natural spawning grounds.

11 SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1 Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

In 2008, WDFW began implementing changes to many of its segregated LCR steelhead programs as the result of development of the *Conservation and Sustainable Fisheries (C&SF) Plan* (WDFW 2010 draft). Through this plan, WDFW used AHA modeling, combined with the best-available estimates of key model assumptions, to adjust segregated program sizes to meet HSRG standards (see **Attachment #3**). Through this effort, WDFW realized that some assumptions of the AHA model (e.g. harvest rates) needed to be validated and actual gene flow/introgression (or pHOS) needed to be monitored. WDFW has since been reviewing existing monitoring programs for the purpose of identifying improvements that would allow for the validation of key assumptions in the AHA model. WDFW initiated implementation of new monitoring efforts and changes to existing monitoring effort in 2008 for the purpose of collecting data/samples that would address the aforementioned modeling assumption validation needs. Subsequent to implementation improvements to the monitoring program, WDFW began development of a study design to estimate actual gene flow/introgression. The following list provides examples of activities being conducted as part of the improved monitoring program:

- **Summer steelhead monitoring (existing)** – provides information on hatchery/wild proportions during tagging/snorkeling as part of a mark-recapture population abundance estimation methodology.
- **Winter steelhead monitoring (existing)** – redd based surveys to estimate abundance of wild winter steelhead populations in LCR tributaries.
- **Fish In Fish Out (FIFO) monitoring (existing) –** provides information on adult and juvenile production for life cycle monitoring – i.e. productivity.
- **Cowlitz Introgression study (new)** – evaluated introgression rates of early winter and early summer hatchery stocks into lower Cowlitz wild winter steelhead population. The Cowlitz River study evaluated the genetic relationship between naturally spawning winter steelhead in the lower Cowlitz River and three hatchery stocks: early summer-run, early winter-run and late winter (endemic Cowlitz River stock). The study found the natural-origin fish were genetically distinct from the hatchery fish; however there was evidence of introgression from the hatchery stocks. The early winter steelhead program showed the highest level of introgression. Since completion of the study, WDFW is proposing to move to a SNPs baseline for future studies/monitoring involving genetic introgression instead of the microsatellite baseline used in the Cowlitz analysis. More specifics on the study design have been added to HGMP section 11.
- **Creel Surveys/ Hooking Mortality Study(new) –** implemented on the Wind (hooking mortality), Washougal and SF Toutle (creel surveys) rivers to evaluate harvest, harvest rates (SF Toutle), wild steelhead interception rates and post release mortality rates during fisheries. Long-term vision is a comprehensive program with a rotating design that moves between key watersheds.
- **Genetic sample collection (new and existing)** – genetic samples are collected from adult wild steelhead populations and naturally produced steelhead smolts during summer

steelhead monitoring, at winter steelhead trapping locations, during FIFO monitoring (smolts) and potentially during creel surveys. These samples and future sample collections may be valuable in assessing gene flow/introgression.

Table J-1 below is from the FHMP Update, Appendix J - Monitoring and Evaluation Plan: Analytical Methods and Monitoring Activities of the FHMP, see attached Appendix J for additional information on specific monitoring activities.

Table J-1. Monitoring activities that will provide the data (measure) that support the analysis for one or more of the populations in the project area.

Code	Name/Description	Analytical Methods Supported	Application (Populations)
MA-A	Carcass/Redd Surveys	AM-1, AM-2	LC: FCH, COH, STHD
MA-B	Juvenile Trapping	AM-1, AM-9, AM-10, AM-14	LC: FCH, COH, STHD, CUT
MA-C	Creel Survey	AM-4, AM-5	All Populations
MA-D	Catch Record Cards	AM-3, AM-4, AM-5, AM-11	LC: FCH, COH, STHD, SPC
MA-E	Hatchery Brood Bio-sampling	AM-6	LC: FCH, COH, STHD, SPC UC: COH, SPC
MA-F	In-hatchery Monitoring	AM-7	All hatchery programs
MA-G	Juveniles at Cowlitz Falls	AM-12	UC: COH, STHD, SPC, FCH
MA-H	Juveniles at Mayfield	AM-13	TIL: COH, STHD, SPC
MA-I	Adults at Separator	AM-11	UC: COH, STHD, SPC, FCH TIL: COH, STHD, SPC
MA-J	Weir Operation	AM-1b	LC: COH, STHD

11.1.1 Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

See 11.1

11.1.2 Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

The Bonneville Power Administration (BPA) funds the evaluation of productivity of Chinook, late winter steelhead, coho and cutthroat trout in the upper Cowlitz River basins. Tacoma Power and WDFW fund the lower Cowlitz River monitoring programs.

11.2 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Monitoring activities follow scientific protocol in handling listed fish. Smolts handled for data collection such as condition factor, length and weight are anesthetized with MS - 222 and placed in recovery tanks before hauling. At the salmon hatchery separation facility, adults can be transferred via water to water in the tanker truck fish to minimize stress.

12 SECTION 12. RESEARCH

12.1 Objective or purpose.

There is no current research associated with this program.

12.2 Cooperating and funding agencies.

Any research is conducted by WDFW and funded through Tacoma Power.

12.3 Principle investigator or project supervisor and staff.

Bryce Glaser (WDFW) and Mark LaRiviere (Tacoma Power)

12.4 Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

Not applicable.

12.5 Techniques: include capture methods, drugs, samples collected, tags applied.

Not applicable.

12.6 Dates or time period in which research activity occurs.

Not applicable.

12.7 Care and maintenance of live fish or eggs, holding duration, transport methods.

Not applicable.

12.8 Expected type and effects of take and potential for injury or mortality.

Not applicable.

12.9 Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

Not applicable.

12.10 Alternative methods to achieve project objectives.

Not applicable.

12.11 List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

Not applicable.

12.12 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

Not applicable.

13 SECTION 13. ATTACHMENTS AND CITATIONS

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Attachment 1: WDFW Virology Sampling 2008-2009 through 2012-2013: Cowlitz Trout Hatchery steelhead.

Source: WDFW Fish Health Lab data 2014 (John Kerwin)

Note: For Cowlitz system salmon data, see Cowlitz Chinook and coho HGMPs.

Hatchery/ Collection site	Stock	Species	Date Sampled	Results	Comments	Life Stage	Sample number	NUMBER OF SAMPLEs						Cell Line	ID	FROZ Date
								OF	POOL	K/S	POOL	fry/visc/other	pools			
COWLITZ T	COWLITZ R	LWSTHD	07/10/08	NEV	diag, 10^{0} – 10^{-2}, whole fry, BP	JUV/08	0710-2			8	3					
COWLITZ T	COWLITZ R	SSTHD	10/15/08	NEV	diag, 10^{0}-10^{-1}	AD	1016-8			17	4					
MERWIN	LEWIS R	SSTHD	12/04/08	**IHNV**	1+/11p OF & 1+/7p K/S , #1-11	AD	1205-1/2	32	11	30	6			ND	E/C	ND
COWLITZ T	COWLITZ R	SSTHD	12/09/08	**IHNV**	10+/12p OF & 7+/12p K/S	AD	1209-4/5	60	12					ND	E/C	ND
MERWIN	LEWIS R	SSTHD	12/11/08	**IHNV**	2+/16p OF & 1+/6p K/S, #12-27	AD	1212-1/2	45	16	24	5			DB	E	02/05/09
MERWIN	LEWIS R	SSTHD	12/16/08	**IHNV**	1+/13p OF, #28-40	AD	1217-9	37	13	42	13			DB	E/C	02/05/09
COWLITZ T	COWLITZ R	WSTHD	12/29/08	**IHNV**	6+/6p OF & K/S	AD	1229-7/8	30	6	9	3			ND	E/C	ND
MERWIN	LEWIS R	WSTHD	12/29/08	NEV	#1-3	AD	1230-9/10	8	3			7	2	ND	E/C	ND
MERWIN	LEWIS R	WSTHD	01/12/09	NEV	#4-9	AD	0113-3/4	16	6	1	1					
COWLITZ T	COWLITZ R	WSTHD	01/13/09	**IHNV**	6+/6p K/S	AD	0115-1			1	1					
COWLITZ T	COWLITZ R	WSTHD	01/20/09	**IHNV**	6+/6p OF	AD	0120-3	30	6	36	8			DB	E/C	05/05/09
MERWIN	LEWIS R	WSTHD	01/21/09	**IHNV**	OF #10-17, K/S #10-14	AD	0122-1/2	24	8	1	1					
COWLITZ T	COWLITZ R	SSTHD	01/23/09	**IHNV**	13+/13p K/S	JUV/08	0123-2			1	1					
COWLITZ T	COWLITZ R	SSTHD	02/05/09	**IHNV**	3+/3p K/S	JUV/08	USFWS - 2974			24	5			ND	E/C	ND
COWLITZ T	COWLITZ R	SSTHD	02/05/09	**IHNV**	2+/2p gills	JUV/08	USFWS - 2974			1	1					
MERWIN	LEWIS R/WILD	WSTHD	04/16/09	NEV	OF & K/S: 10^{0}-10^{-3}	AD	0417-1/2	1	1	3	2					
MERWIN	LEWIS R/WILD	WSTHD	04/16/09	NEV	male #12, spawned, sample frozen	AD	0501-4			1	1					
COWLITZ T	COWLITZ R	LWSTHD	04/21/09	**IHNV**	7+/8p OF & K/S	AD	0422-1/2	36	8	1	1					
MERWIN	LEWIS R/WILD	WSTHD	04/23/09	NEV	male mortality, sample frozen	AD	0430-4			3	2					
MERWIN	LEWIS R/WILD	WSTHD	04/26/09	NEV	male mortality, sample frozen	AD	0430-5			3	2					
COWLITZ T	COWLITZ R	LWSTHD	04/28/09	**IHNV**	5+/5p OF & K/S	AD	0429-2/3	24	5	7	5					
MERWIN	LEWIS R/WILD	WSTHD	04/28/09	NEV	male mortality, fresh	AD	0430-6			3	2					
MERWIN	LEWIS R/WILD	WSTHD	04/29/09	NEV	OF lost in transit, dil w 1ml AB, spawned	AD	0430-1/2	1	1	4	4					
MERWIN	LEWIS R/WILD	WSTHD	04/29/09	NEV	male mortality, fresh	AD	0430-3			2	2					
MERWIN	LEWIS R/WILD	WSTHD	04/30/09	NEV	mortality, #58	AD	0501-5			4	4					
MERWIN	LEWIS R/WILD	WSTHD	05/01/09	NEV	F #23 & M #19 & 39, spawned	AD	0501-2/3	1	1	8	3					
MERWIN	LEWIS R/WILD	WSTHD	05/11/09	NEV	F #63 & M #57 & 40	AD	0513-2/3	1	1	17	4					
MERWIN	LEWIS R/WILD	WSTHD	05/13/09	NEV	F #66-67 & M #17/51, 49/45, 34 (mort)	AD	0514-1/2	2	2	30	6			ND	E/C	ND
MERWIN	LEWIS R/WILD	WSTHD	05/14/09	NEV	F #68 & M #41/55	AD	0515-1/2	1	1					ND	E/C	ND
MERWIN	LEWIS R/WILD	WSTHD	05/19/09	NEV	F #65 & 69, M #46 & 56	AD	0521-1/2	2	2	24	5			DB	E	02/05/09
MERWIN	LEWIS R/WILD	WSTHD	05/21/09	NEV	F #74, M #25	AD	0522-1/2	1	1	42	13			DB	E/C	02/05/09
MERWIN	LEWIS R/WILD	WSTHD	05/26/09	NEV	F #64 & 70, M #73 & 71	AD	0527-2/3	2	2	9	3			ND	E/C	ND
COWLITZ T	COWLITZ R	SSTHD	07/27/09	NEV	diag, rcwy A-3, 10^{0}-10^{-2}	JUV/09	0728-1			6	2					
COWLITZ T	COWLITZ R	SSTHD	07/27/09	NEV	diag, rcwy A-3, 10^{0}-10^{-2}	JUV/09	0728-1			6	2					
MERWIN	LEWIS R	SSTHD	09/17/09	**IHNV**	2+/3 K/S, diag, EPC 10^{0}-10^{-3}	IMM AD	0918-5			3	3					10/08/09
MERWIN	LEWIS R	SSTHD	09/17/09	**IHNV**	2+/3 K/S, diag, EPC 10^{0}-10^{-3}	IMM AD	0918-5			3	3					10/08/09
MERWIN	LEWIS R	SSTHD	11/30/09	**IHNV**	2+/16p OF & 1+/16p K/S	AD	1201-19/20	45	16	45	16			PCR	E/C	12/23/09
MERWIN	LEWIS R	SSTHD	11/30/09	**IHNV**	2+/16p OF & 1+/16p K/S	AD	1201-19/20	45	16	45	16			PCR	E/C	12/23/09
MERWIN	LEWIS R	SSTHD	12/07/09	**IHNV**	2+/13p OF & 2+/5p K/S, #17-29	AD	1208-2/3	39	13	15	5				E/C	
MERWIN	LEWIS R	SSTHD	12/07/09	**IHNV**	2+/13p OF & 2+/5p K/S, #17-29	AD	1208-2/3	39	13	15	5				E/C	
COWLITZ S	COWLITZ R	SSTHD	12/09/09	**REOVIRUS**	1+/12p K/S	AD	1210-11/12	60	12	60	12			F&P	C	01/26/10
COWLITZ S	COWLITZ R	SSTHD	12/09/09	**REOVIRUS**	1+/12p K/S	AD	1210-11/12	60	12	60	12			F&P	C	01/26/10
MERWIN	LEWIS R	SSTHD	12/14/09	**IHNV**	3+/4p OF, #30-33	AD	1215-17	12	4					DB	E/C	01/08/10
MERWIN	LEWIS R	SSTHD	12/14/09	**IHNV**	3+/4p OF, #30-33	AD	1215-17	12	4					DB	E/C	01/08/10

Hatchery/ Collection site	Stock	Species	Date Sampled	Results	Comments	Life Stage	Sample number	NUMBER OF SAMPLEs						Cell Line	ID	FROZ Date
								OF	POOL	K/S	POOL	fry/visc/other	pools			
COWLITZ T	COWLITZ R	WSTHD	12/28/09	NEV		AD	1229-1/2	20	4	20	4					
MERWIN	LEWIS R	WSTHD	12/28/09	NEV	#1-5	AD	1229-9/10	13	5	13	5					
COWLITZ T	COWLITZ R	WSTHD	12/28/09	NEV		AD	1229-1/2	20	4	20	4					
MERWIN	LEWIS R	WSTHD	12/28/09	NEV	#1-5	AD	1229-9/10	13	5	13	5					
MERWIN	LEWIS R	WSTHD	01/04/10	**IHNV**	1+/1p K/S, #6-9	AD	0105-3/4	12	4	12	4			PCR	E	01/26/10
MERWIN	LEWIS R	WSTHD	01/11/10	NEV	#10, 11	AD	0112-3/4	7	2	7	2					
COWLITZ T	COWLITZ R	WSTHD	01/12/10	**IHNV**	1+/4p OF	AD	0113-3/4	20	4	20	4			PCR	E/C	01/26/10
COWLITZ T	COWLITZ R	WSTHD	01/19/10	NEV		AD	0120-13/14	20	4	20	4					
MERWIN	LEWIS R	WSTHD	01/19/10	**IHNV**	1+/4p OF & K/S, #12-15	AD	0120-3/4	10	4	10	4				E/C	
COWLITZ T	COWLITZ R	WSTHD	01/25/10	NEV		JUV/09	0125-1			60	12					
MERWIN	LEWIS R/WILD	WSTHD	03/17/10	**IHNV**	1+/1p OF & K/S, #12-15	AD	0318-1/2	1	1	1	1			PCR	E/C	04/01/10
MERWIN	LEWIS R/WILD	WSTHD	03/26/10	**IHNV**	1+/1, #12	AD	0326-4			1	1				C	04/20/10
MERWIN	LEWIS R/WILD	WSTHD	04/01/10	NEV	#37	AD	0402-1/2	1	1	1	1					
MERWIN	LEWIS R/WILD	WSTHD	04/01/10	**IHNV**	1+/1 OF & K/S, #11	AD	0402-3/4	1	1	1	1				E/C	04/14/10
MERWIN	LEWIS R/WILD	WSTHD	04/06/10	NEV	F#52	AD	0407-2/3	1	1	1	1					
MERWIN	LEWIS R/WILD	WSTHD	04/09/10	NEV	F#56	AD	0409-2/3	1	1	1	1					
MERWIN	LEWIS R/WILD	WSTHD	04/12/10	NEV	#21, 57, 59	AD	0413-3/4	3	3	3	3					
MERWIN	LEWIS R/WILD	WSTHD	04/13/10	NEV	#44, 51, 66	AD	0414-4/5	3	3	3	3					
MERWIN	LEWIS R/WILD	WSTHD	04/19/10	**IHNV**	5+/5 OF & K/S; #47, 64, 67, 69, 72	AD	0421-2/3	5	5	5	5				E/C	05/21/10
COWLITZ S	COWLITZ R	LWSTHD	04/21/10	**IHNV**	1+/6p OF & K/S	AD	0421-7/8	30	6	30	6			SN	E/C	05/05/10
MERWIN	LEWIS R/WILD	WSTHD	04/26/10	NEV	F#70, 77	AD	0427-4/5	2	2	2	2					
COWLITZ	COWLITZ R	LWSTHD	04/28/10	**REOVIRUS**	K/S: 1+/6P	AD	0428-1/2		6		6				C	06/03/10
MERWIN	LEWIS R/WILD	WSTHD	05/14/10	**IHNV**	2+/3 OF; #88, 95, 99; spawned on Friday, samples frozen over weekend	AD	0518-2/3	3	3	3	3				E/C	06/17/10
COWLITZ S	COWLITZ R	LWSTHD	04/28/10	**REOVIRUS**	1+/6p K/S	AD	0428-1/2	30	6	30	6			F&P	C	06/03/10
MERWIN	LEWIS R	SSTHD	07/15/10	**IHNV**	1+/2p K/S	IMM AD	0716-1			2	2			PCR	E	08/05/10
MERWIN	LEWIS R	SSTHD	11/30/10	NEV	#1-4	AD	1201-1/2	12	4	12	4					
MERWIN	LEWIS R	SSTHD	12/06/10	NEV	#5-8	AD	1206-1/2	10	4	10	4					
COWLITZ T	COWLITZ R	SSTHD	12/08/10	NEV		AD	1208-16/17	60	12	60	12					
COWLITZ T	COWLITZ R	WSTHD	01/05/11	**IHNV**	3+/4p OF & 4+/4p K/S	AD	0105-13/14	20	4	20	4					
MERWIN	LEWIS R	SSTHD	12/13/10	NEV	#9-14	AD	1214-5/6	16	6	16	6					
COWLITZ T	COWLITZ R	WSTHD	01/12/11	**IHNV**	2+/2p OF & 1+/2p K/S	AD	0112-13/14	10	2	10	2				E/C	
MERWIN	LEWIS R	WSTHD	12/29/10	NEV		AD	1229-25/26	15	5	15	5					
MERWIN	LEWIS R	WSTHD	01/05/11	NEV	#6-8, EPC 10^{0}-10^{-2}	AD	0106-7/8	9	3	9	3					
COWLITZ S	COWLITZ R	LWSTHD	02/14/11	NEV	diag, pre spawning mortality,10^{0}-10^{-3}	AD	0215-6			1	1					
MERWIN	LEWIS R	WSTHD	04/01/11	NEV	#22	AD	0402-1/2	1	1	1	1					
COWLITZ S	COWLITZ R	LWSTHD	04/12/11	NEV		AD	0412-2/3	15	3	15	3					
MERWIN	LEWIS R/WILD	WSTHD	04/15/11	NEV	#34	AD	0415-1/2	1	1	1	1					
MERWIN	LEWIS R	SSTHD	12/20/10	**IHNV**	3+/8p OF & 1+/8p K/S, #15-22	AD	1220-5/6	24	8	24	8			DB	E/C	01/04/11
COWLITZ S	COWLITZ R	LWSTHD	04/19/11	NEV		AD	0419-5/6	15	3	15	3					
MERWIN	LEWIS R	WSTHD	01/12/11	**IHNV**	1+/2p OF & K/S, #9-10	AD	0113-4/5	6	2	6	2			S/N		02/25/11
MERWIN	LEWIS R	WSTHD	05/26/11	**IHNV**	Int 6, 10^{0}-10^{-3}, diag	JUV/11	0526-3					15	3	PCR	E/C	
MERWIN	LEWIS R	WSTHD	05/31/11	**IHNV**	10^{0}-10^{-3}, fresh morts	JUV/11	0531-1					20	4			
MERWIN	LEWIS R/WILD	WSTHD	04/11/11	**IHNV**	2+/2p K/S, males, #25-26	AD	0412-1			2	2			DB	E/C	04/26/11
COWLITZ S	COWLITZ R	LWSTHD	04/26/11	NEV	OF: #1-3, 10; K/S: #7-10	AD	0427-2/3	18	4	18	4					
MERWIN	LEWIS R/WILD	WSTHD	04/18/11	**IHNV**	2+/2p OF & K/S; F #13, 27	AD	0419-3/4	2	2	2	2				E/C	
MERWIN	LEWIS R/WILD	WSTHD	04/25/11	**IHNV**	1/3p OF & 3+/9p K/S; F #39, 43, 44 & M #15, 24, 31, 35, 37, 38	AD	0426-1/2	3	3	9	9				E/C	
MERWIN	LEWIS R/WILD	WSTHD	04/28/11	**IHNV**	2+/2p OF & 4+/4p K/S; F #36, 65 & M #23, 28	AD	0429-2/3	2	2	4	4				E/C	

Hatchery/ Collection site	Stock	Species	Date Sampled	Results	Comments	Life Stage	Sample number	NUMBER OF SAMPLEs						Cell Line	ID	FROZ Date
								OF	POOL	K/S	POOL	fry/visc/other	pools			
MERWIN	LEWIS R/WILD	WSTHD	05/02/11	**IHNV**	1+/1p OF & 1+/3p K/S; F #68 & M #30, 61	AD	0504-8/9	1	1	3	3				E/C	
MERWIN	LEWIS R/WILD	WSTHD	05/12/11	**IHNV**	F #31, 50, 66, 74 & M #29, 62, 67, 75	AD	0513-1/2	4	4	8	8				E/C	
MERWIN	LEWIS R/WILD	WSTHD	06/06/11	**IHNV**	2+/2p	JUV/11	WADDL					10	2			
COWLITZ S	COWLITZ R	LWSTHD	05/03/11	NEV	#11-13	AD	0503-1/2	12	3	12	3					
COWLITZ T	COWLITZ R	WSTHD	12/29/10	**IHNV**	2+/6p OF & 4+/6p K/S	AD	1229-21/22	28	6	28	6					01/11/11
MERWIN	LEWIS R	SSTHD	12/29/10	**IHNV**	3+/12p & 2+/12p K/S, #23-34, EPC 10^{0}-10^{-3}	AD	1229-23/24	36	12	36	12				E/C	
MERWIN	LEWIS R/WILD	WSTHD	05/16/11	NEV	EPC 10^{0}-10^{-3}; F #84-85 & M #86-87	AD	0517-2/3	2	2	4	4					
MERWIN	LEWIS R/WILD	WSTHD	05/26/11	NEV	healthy, 10^{0}-10^{-1}, from hen 22	JUV/11	0526-1					10	2			
MERWIN	LEWIS R/WILD	WSTHD	05/26/11	NEV	healthy,10^{0}-10^{-1}, from hen 34	JUV/11	0526-2					10	2			
MERWIN	LEWIS R/W	WSTHD	07/21/11	NEV	morts from 1R1, diag 10^{0}-10^{-2}	JUV/11	0722-1					10	2			
MERWIN	LEWIS R/W	WSTHD	07/21/11	NEV	morts from 1R6, diag 10^{0}-10^{-3}	JUV/11	0722-2					5	1			
MERWIN	LEWIS R	SSTHD	11/28/11	NEV	Pools 1-19 have 3 fish, pools 20+21 have 2 fish	AD	1129-5/6	61	21	61	21					
MERWIN	LEWIS R	SSTHD	12/07/11	**IHNV**	#22-39; 2+/18P	AD	1208-3	53	18					DB		12/27/11
MERWIN	LEWIS R	SSTHD	12/12/11	NEV	#40-45, #43 AND 45 ARE 2 FISH/POOL	AD	1213-4	16	6							
COWLITZ T	COWLITZ R	SSTHD	12/15/11	NEV		AD	1216-3/4	60	12	60	12					
MERWIN	LEWIS R	WSTHD	12/28/11	**IHNV**	OF: F#1-5, 4+/5p; K/S: F#1-5, M#1-5, 10+/10p	AD	1230-3/4	14	5	28	10			SN	E/C	1/13/12
MERWIN	LEWIS R	WSTHD	01/04/12	**IHNV**	#6, 7, 8; OF: 3+/3P; K/S: 5+/6P	AD	0105-22/23	9	3	18	6				E/C	
MERWIN	LEWIS R	WSTHD	01/11/12	**IHNV**	OF:#9-12, 1+/4P; K/S: F#9-12, M#9-10, 3+/6P	AD	0112-5/6	10	4	14	6					
COWLITZ T	TILTON R/W	LWSTHD	03/27/12	NEV		AD	0328-7	1	1							
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	03/27/12	NEV		AD	0328-8	2	1							
COWLITZ T	TILTON R/W	LWSTHD	04/03/12	NEV	Diag 10^{0}-10^{-3}	AD	0405-3	1	1							
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	04/03/12	NEV	Diag 10^{0}-10^{-3}	AD	0405-4	2	1							
MERWIN	LEWIS R/W	LWSTHD	04/10/12	**IHNV**	OF: TN-9, 1+/1P; K/S: TN-2, 1+/1P	AD	0411-9/10	1	1	1	1			SN	E/C	4/23/12
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	04/11/12	NEV		AD	0411-13	2	1							
COWLITZ T	COWLITZ R	LWSTHD	04/16/12	NEV		AD	0417-4/5	28	6	30	6					
MERWIN	LEWIS R/W	LWSTHD	04/17/12	**IHNV**	OF: #2-5; K/S: TN#8,11, 12,13, 3+/4P	AD	0419-1/2	4	4	4	4				E/C	
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	04/18/12	NEV		AD	0419-7	3	3							
COWLITZ T	COWLITZ R	LWSTHD	04/24/12	**IHNV**	OF: 1+/7P; K/S: 1+/6P	AD	0426-2/3	32	7	30	6			PCR	E/C	5/11/12
COWLITZ T	TILTON R/W	LWSTHD	04/24/12	NEV		AD	0426-4	3	3							
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	04/24/12	**IHNV**	1+/3P	AD	0426-5	11	3					PCR	E/C	5/11/12
MERWIN	LEWIS R/W	LWSTHD	04/25/12	**IHNV**	OF: #6, 7, 1+/2P; K/S: TN#22, 30, 39, 43, 3+/4P	AD	0427-3/4	2	2	4	4				E/C	
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	05/02/12	NEV		AD	0504-1	2	2							
COWLITZ T	TILTON R/W	LWSTHD	05/02/12	**IHNV**	2+/5P	AD	0504-2	5	5					PCR	E/C	5/18/12
MERWIN	LEWIS R/W	LWSTHD	05/02/12	**IHNV**	OF: #8, 9, 2+/2P; K/S: TN#66, 69, 2+/2P	AD	0504-3/4	2	2	2	2					
MERWIN	LEWIS R/W	LWSTHD	05/03/12	**IHNV**	OF: #10 (F#02163), NEV; K/S: TN#44, 40, 2+/2P	AD	0504-5/6	1	1	2	2					
MERWIN	LEWIS R/W	LWSTHD	05/08/12	**IHNV**	OF: #11-15, 5+/5P; K/S: TN#32, 33, 41, 64, MT#3, 2+/5P	AD	0510-1/2	5	5	5	5				E/C	
MERWIN	LEWIS R/W	LWSTHD	05/09/12	**IHNV**	OF: #16; K/S: TN#19, 28, 2+/2P	AD	0510-3/4	1	1	2	2				E/C	
COWLITZ T	UPPER COWLITZ R/ W	LWSTHD	05/09/12	NEV		AD	0510-5	6	6							
COWLITZ T	TILTON R/W	LWSTHD	05/09/12	NEV		AD	0510-6	2	2							
MERWIN	LEWIS R/W	LWSTHD	05/14/12	**IHNV**	OF: #17, 1+/1P; K/S: TN#29, 1+/1P	AD	0515-1/2	1	1	1	1				E/C	
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	05/16/12	**IHNV**	#1-7; 3+/7P	AD	0518-4	7	7							
COWLITZ T	TILTON R/W	LWSTHD	05/16/12	**IHNV**	#1-4; 3+/4P	AD	0518-5	4	4							
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	05/23/12	**IHNV**	1+/1P	AD	0523-2	1	1							
MERWIN	LEWIS R/W	LWSTHD	05/29/12	**IHNV**	OF: TN-72 1+/1P; K/S: MT-7,10 1+/2P	AD	0530-3/4	1	1	2	2					
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	05/29/12	NEV		AD	0531-3	1	1							
MERWIN	LEWIS R	SSTHD	11/28/12	NEV	OF: #1-15, No #3 or #4	AD	0103-21/22	12	5	23	5					
MERWIN	LEWIS R	SSTHD	12/03/12	NEV	OF: #16-22 K/S: #10-12	AD	0110-9	6	2							
COWLITZ T	COWLITZ R	SSTHD	12/12/12	**IHNV**	OF: 6+/6P; K/S 2+/6P	AD	0327-15	2	1							E/C

Hatchery/ Collection site	Stock	Species	Date Sampled	Results	Comments	Life Stage	Sample number	NUMBER OF SAMPLEs						Cell Line	ID	FROZ Date
								OF	POOL	K/S	POOL	fry/visc/other	pools			
COWLITZ S	COWLITZ R	SSTHD	12/19/12	**IHNV**	OF: 6+/6P; K/S 1+/6P	AD	0403-12	1	1							E/C
MERWIN	LEWIS R	WSTHD	01/02/13	NEV	OF: #8-12	AD	0409-9	3	1							
MERWIN	LEWIS R	WSTHD	01/09/13	NEV	#13,14	AD	0409-8	3	1			30	6			
COWLITZ	TILTON WILD	WSTHD	03/26/13	**IHNV**	1+/1P	AD	0411-1	1	1							
COWLITZ T	COWLITZ R	LWSTHD	04/02/13	**IHNV**	1+/1P	AD	0417-8	2	1							
COWLITZ T	TILTON R WILD	LWSTHD	04/08/13	**IHNV**	1+/1P	AD	0417-6/7	35	7	35	7					
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	04/08/13	**IHNV**	1+/1P	AD	0419-1	1	1							
MERWIN	LEWIS R	LWSTHD	04/10/13	NEV	MT-5	AD	0424-4	4	1							
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	04/16/13	**IHNV**		AD	0424-3	2	1							
COWLITZ T	COWLITZ R/H	LWSTHD	04/17/13	**IHNV**		AD	0424-2	25	5							
MERWIN	LEWIS R	LWSTHD	04/18/13	NEV	TN-19	AD	0430-3	5	1							
COWLITZ	UPPER COWLITZ R	LWSTHD	04/22/13	**IHNV**		AD	0430-4	9	2							
COWLITZ T	TILTON R WILD	LWSTHD	04/22/13	**IHNV**		AD	0430-1	5	5							
COWLITZ T	COWLITZ R/H	LWSTHD	04/23/13	**IHNV**		AD	0430-2			25	5					
COWLITZ T	TILTON R WILD	LWSTHD	04/29/13	**IHNV**	1+/1P	AD	0507-4	8	2							E/C
COWLITZ T	UPPER COWLITZ R/ W	LWSTHD	04/29/13	**IHNV**	2+/2P	AD	0507-5	1	1							E/C
MERWIN	LEWIS R	WSTHD	04/29/13	NEV	#1 orange 100, #2 pit tag#5 699E75, #3 orange 99, #4 white 257, #5 orange 19	AD	0508-1	1	1							E/C
COWLITZ T	COWLITZ R/H	LWSTHD	04/30/13	**IHNV**	5+/5P	AD	0514-2	1	1							E/C
COWLITZ T	TILTON R WILD	LWSTHD	05/06/13	**IHNV**	2+/2P	AD	0514-1	2	1							E/C
COWLITZ T	TILTON R WILD	LWSTHD	05/06/13	**IHNV**	1+/1P	AD	0522-4	4	1							E/C
MERWIN	LEWIS R/ W	WSTHD	05/06/13	**IHNV**	1+/1P, TN-29	AD	3701 usfws	1	1							E/C
COWLITZ T	TILTON R WILD	LWSTHD	05/13/13	**IHNV**	1+/1P	AD	1227-13/14	19	7	37	8					
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	05/13/13	**IHNV**	1+/1P	AD	0103-21/22	12	5	23	5					
COWLITZ T	UPPER COWLITZ R/W	LWSTHD	05/21/13	**IHNV**		AD	0110-9	6	2							
COWLITZ T	TILTON R WILD	LWSTHD	05/28/13	**NEV**	sent to usfws lab to run	AD	0327-15	2	1							E/C
MERWIN	LEWIS R	WSTHD	12/26/13	NEV		AD	0403-12	1	1							E/C

14 SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

15 ADDENDUM A. PROGRAM EFFECTS ON OTHER (AQUATIC OR TERRESTRIAL) ESA-LISTED POPULATIONS. (Anadromous salmonid effects are addressed in Section 2).

15.1 List all ESA permits or authorizations for USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species associated with the hatchery program.

The WDFW and the USFWS have a Cooperative Agreement pursuant to section 6(c) of the Endangered Species Act that covers the majority of the WDFW actions, including hatchery operations.

> "The department is authorized by the USFWS for certain activities that may result in the take of bull trout, including salmon/steelhead hatchery broodstocking, hatchery monitoring and evaluation activities and conservation activities such as adult traps, juvenile monitoring, spawning ground surveys..."

15.2 Describe USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species and habitat that may be affected by hatchery program.

Several USFWS listed and candidate species are found in Cowlitz County, however the hatchery operations and facilities for this program do not fall within the critical habitat for any of these species. As such there are no effects anticipated for these species.

Listed or candidate species:
"No effect" for the following species:

Bull trout (*Salvelinus confluentus*) – Threatened (Critical Habitat Designated)
Nelson's checker-mallow (*Sidalcea nelsoniana*) –Threatened
Marbled murrelet (*Brachyramphus marmoratus*) –Threatened (Critical Habitat Designated)
Columbian White-Tailed deer (*Odocoileus virginianus leucurus*) – Endangered
Gray Wolf (*Canis lupus*) –Threatened
Northern Spotted owl (*Strix occidentalis caurina*) –Threatened (Critical Habitat Designated)

Candidate Species
North American wolverine *(Gulo gulo luteus)* – contiguous U.S. DPS

15.3 Analyze effects.

Not applicable.

15.4 Actions taken to minimize potential effects.

Program steelhead are released fully smolted to foster rapid outmigration from the basin and to minimize predation and residualism risks.

15.5 References

Not applicable.

16 "Take" Tables

Table 1: Estimated listed salmonid take levels by hatchery activity.

Listed species affected: Chinook (*Oncorhynchus tshawytscha*) Steelhead *(Oncorhynchus mykiss*) Coho (*Oncorhynchus kisutch*) Chum (*Oncorhynchus keta*)	**ESU/Population:** Lower Columbia River Chinook Lower Columbia River Steelhead Lower Columbia River Coho Columbia River Chum	**Activity:** Cowlitz Winter-late Steelhead Program
Location of hatchery activity: Cowlitz Trout Hatchery/Cowlitz River (RKm 66)	**Dates of activity:** December-May	**Hatchery program operator:** WDFW

Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harass	TBD	TBD	TBD	TBD
Collect for transport	TBD	TBD	TBD	TBD
Capture, handle, and release	TBD	TBD	TBD	TBD
Capture, handle, tag/mark/tissue sample, and release	TBD	TBD	TBD	TBD
Removal (e.g. broodstock)	TBD	TBD	TBD	TBD
Intentional lethal take	TBD	TBD	TBD	TBD
Unintentional lethal take	TBD	TBD	TBD	TBD
Other Take (specify)	TBD	TBD	TBD	TBD

Take Table to be submitted to NOAA-NMFS, in progress. Will include monitoring activities.